

# **Developing a Successful Technology & Innovation Strategy**

## **KIC Climate Summer School 2010**

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**Program manager Valorisation Centre**

**Delft University of Technology**

**Who are you, and why did you come?**

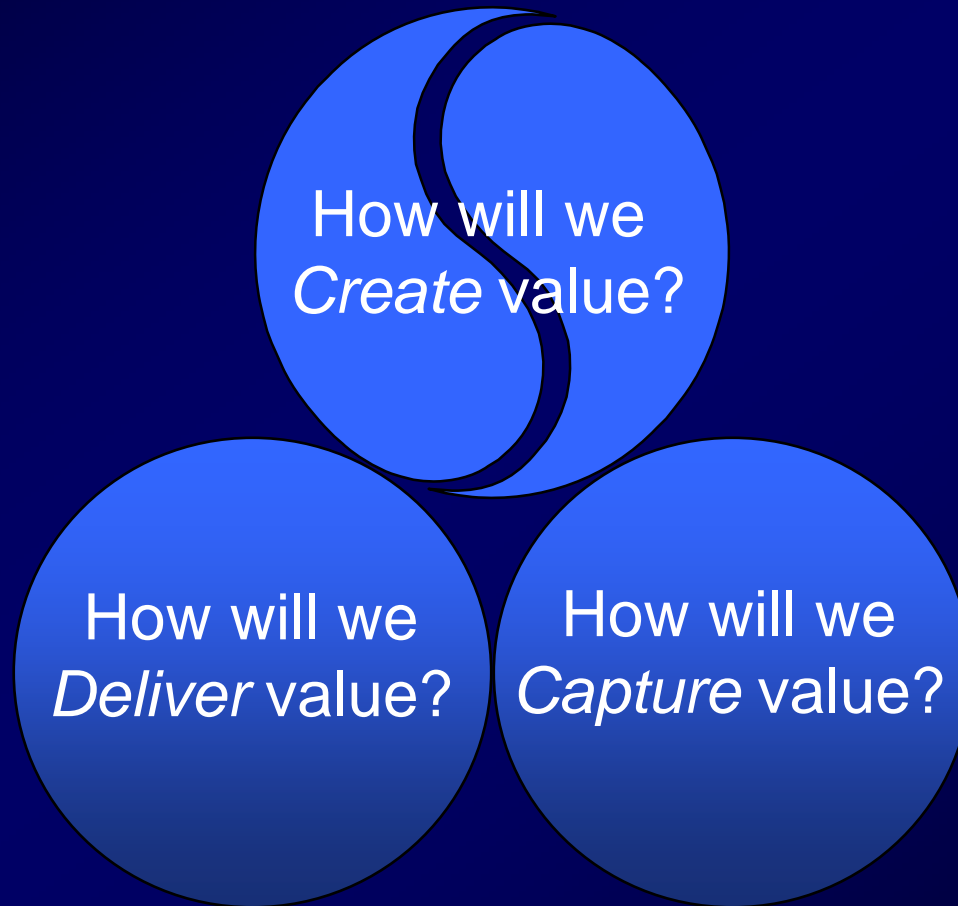
# Who am I?

- Program manager at Valorisation Centre/TTO TU Delft
- Program manager Electric Mobility Innovation
- Fund management Sustainable Mainport Innovation Fund
- Former Director of Clean Tech Incubator DNAMO in Rotterdam
  
- MSc/Eng. in Systems Sciences, WUR
- PhD in Innovation Management, Eindhoven UoT
  
- Interest: academic entrepreneurship, technological innovation
- Work in: Chemical industry, Medical technology, Airport operations, Clean Tech, Automotive, Urban development

# Technology and innovation strategy ?



# Effective strategies answer three key questions:



- How will we create value?
  - How will the technology evolve?
  - How will the market change?
- How will we capture value?
  - How should we design the business model?
  - Where should we compete in the value chain?
  - How should we compete if standards are important?
- How will we deliver value?
  - How do we manage the core business and growth simultaneously?
  - How do we use our strategy to drive real resource allocation?

# Outline for this session:

- **Why do I need an innovation/technology strategy?**
- **How will we create value?**
  - How will the technology evolve?
  - How will the market change?
- **How will we capture value?**
  - How should we design the business model?
  - How should we compete if standards are important?

**Why have a strategy?**



# **Why have a strategy?**

- 1. To make choices**

# Is This Your Project Pipeline?



# Overload at PreQuip

Active Projects (formal development projects by number)	Resources Required for Completion (months)	Months to Completion (desired)	Implied Development Resource Allocation (months)		
			This year	Next year	Year after that
1	54	8	40	14	0
2	123	24	38	62	23
3	86	12	50	36	0
4	286	20	92	172	22
5	24	4	24	0	0
.					
.					
.					
26	352	36	48	150	120
27	75	9	62	13	0
28	215	30	40	80	95
29	153	18	60	93	0
30	29	3	29	0	0
All Other Support Activity (customer support, troubleshooting)	—	—	430	430	430
Total Development Requirements	—	—	2783	2956	2178
Available Resources (months)	—	—	960	960	960
<b>Rate of Utilization (percent)</b>	<b>—</b>	<b>—</b>	<b>289.9</b>	<b>307.9</b>	<b>226.9</b>

# Why is it so hard to kill project #26?

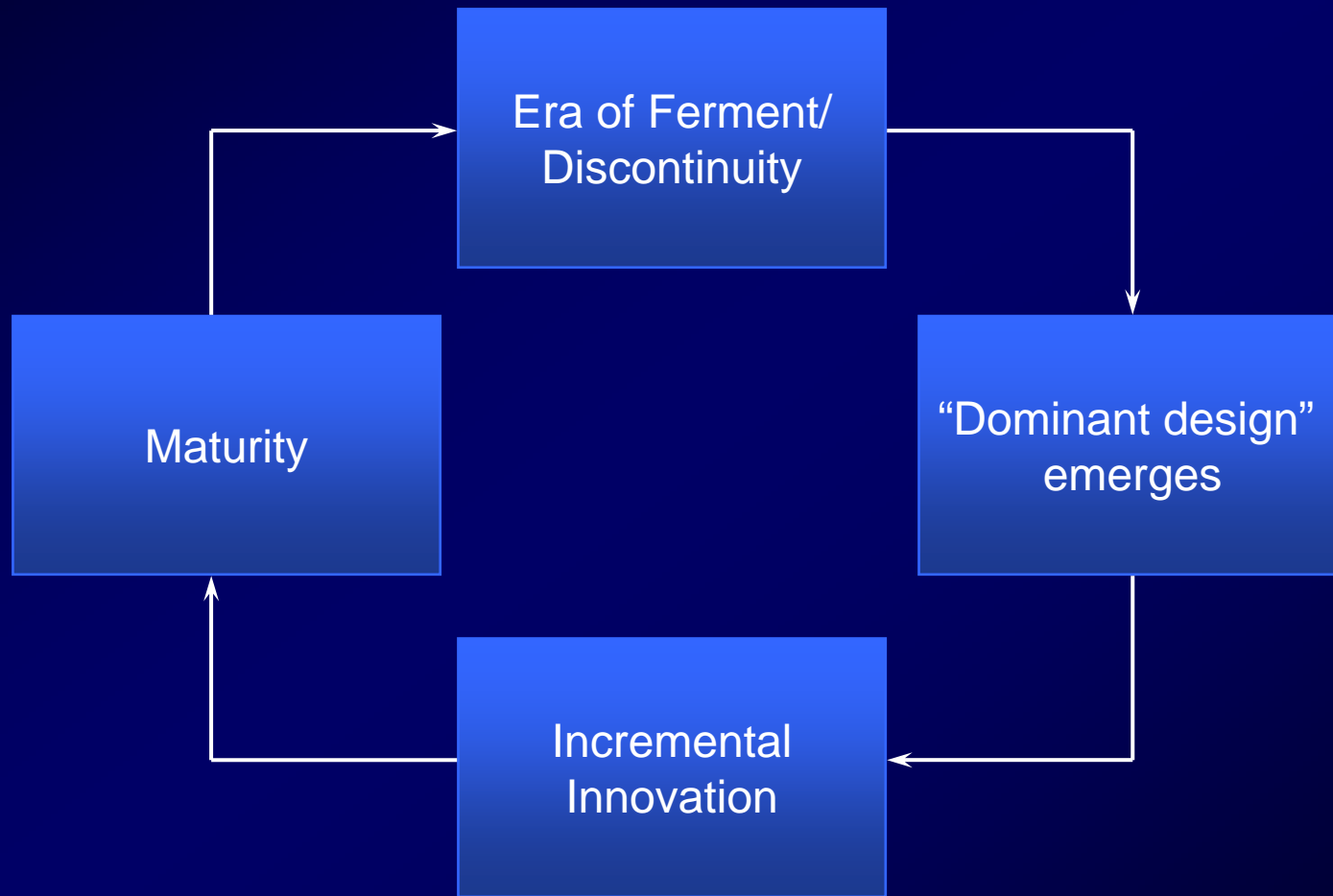
- It's a “good” project!
- Good managers can meet stretch goals  
(and I'm a good manager)
- Making difficult decisions takes time & energy

*It's very hard to kill projects without a strategy*

**Reasons to have a strategy:**

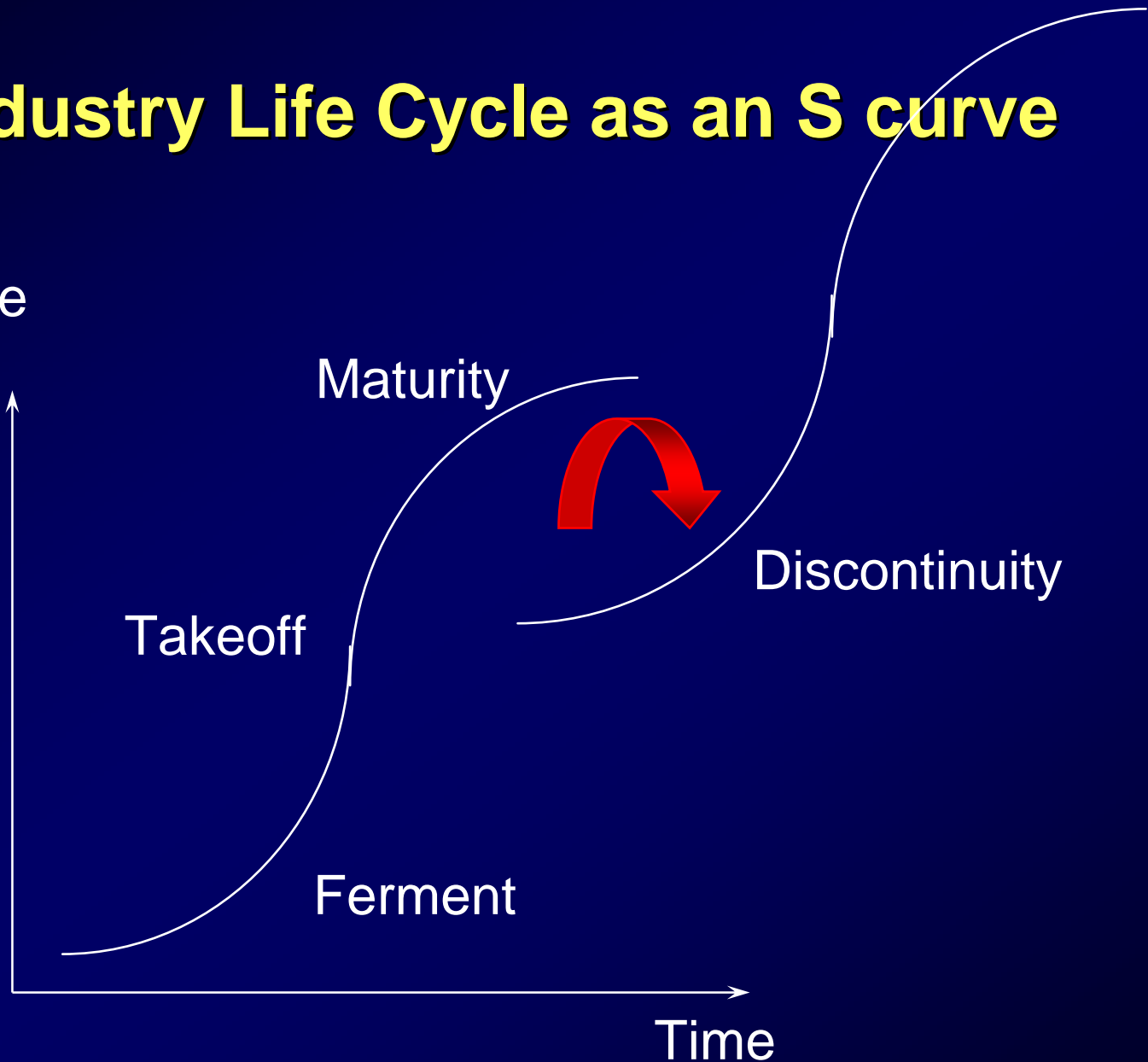
**2. To be able to change it**

# A Key Framework: The industry life cycle

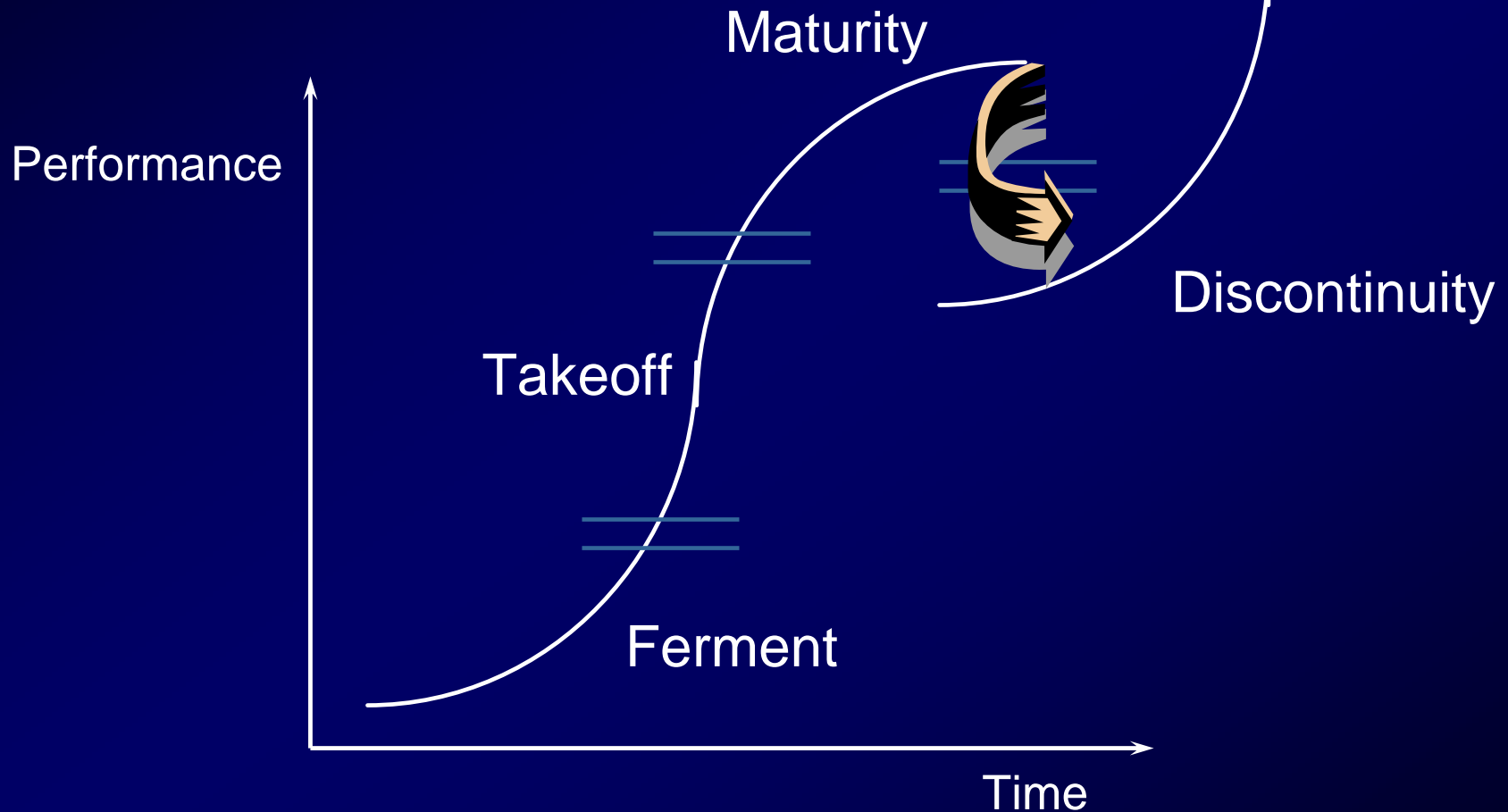


# The Industry Life Cycle as an S curve

Performance



# The S-curve Maps Major Transitions



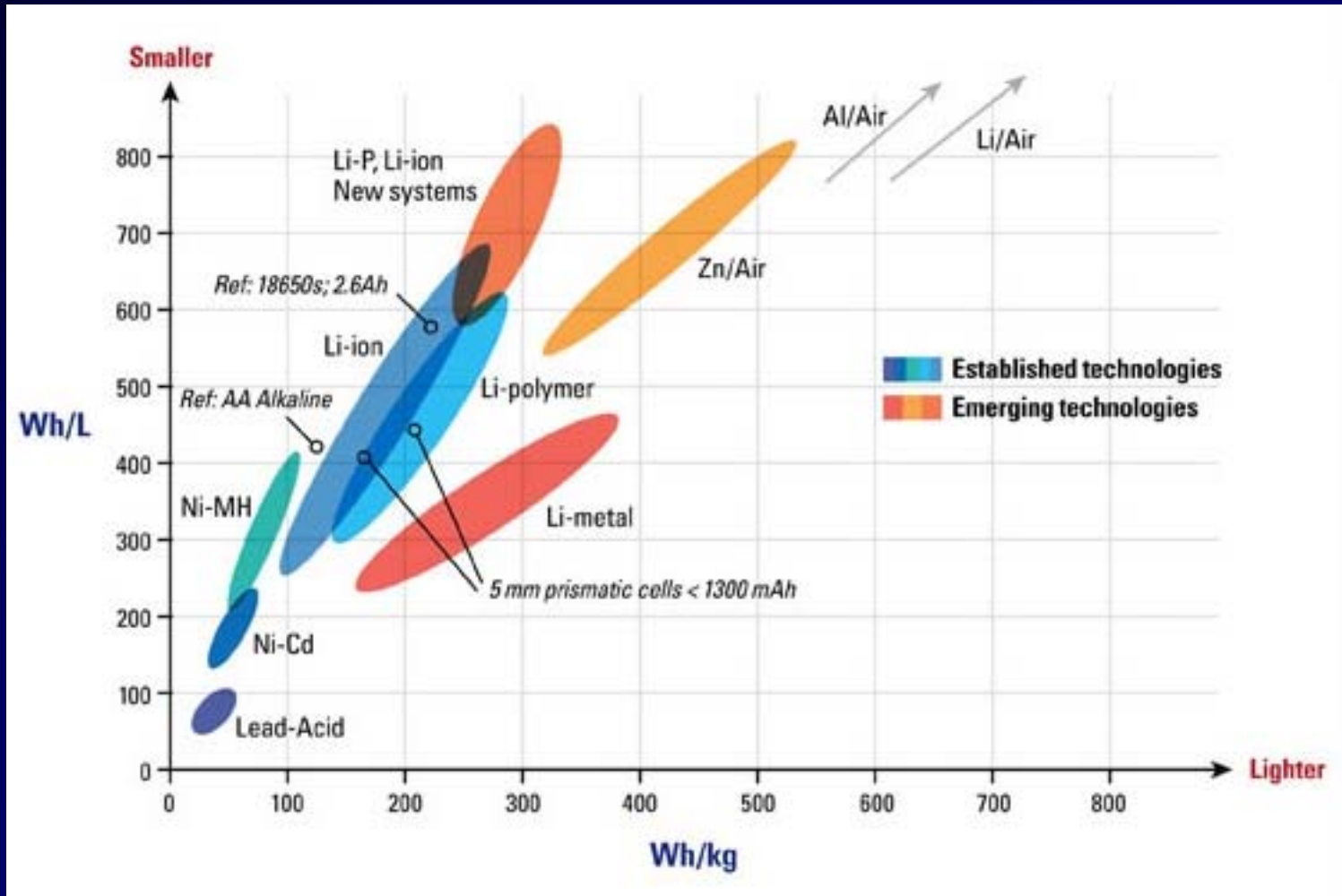


# Transitions often challenge existing organizations severely

Cumulate share of sales of photolithographic alignment equipment, 1962-1986, by generation

	Contact	Proximity	Scanner	S&R (1)	S&R (2)
Cobilt	44		<1		
Kasper	17	8		7	
Canon		67	21	9	
P-Elmer			78	10	<1
GCA				55	12
Nikon					70
Total	61	75	99+	81	82+

# Battery technology developments

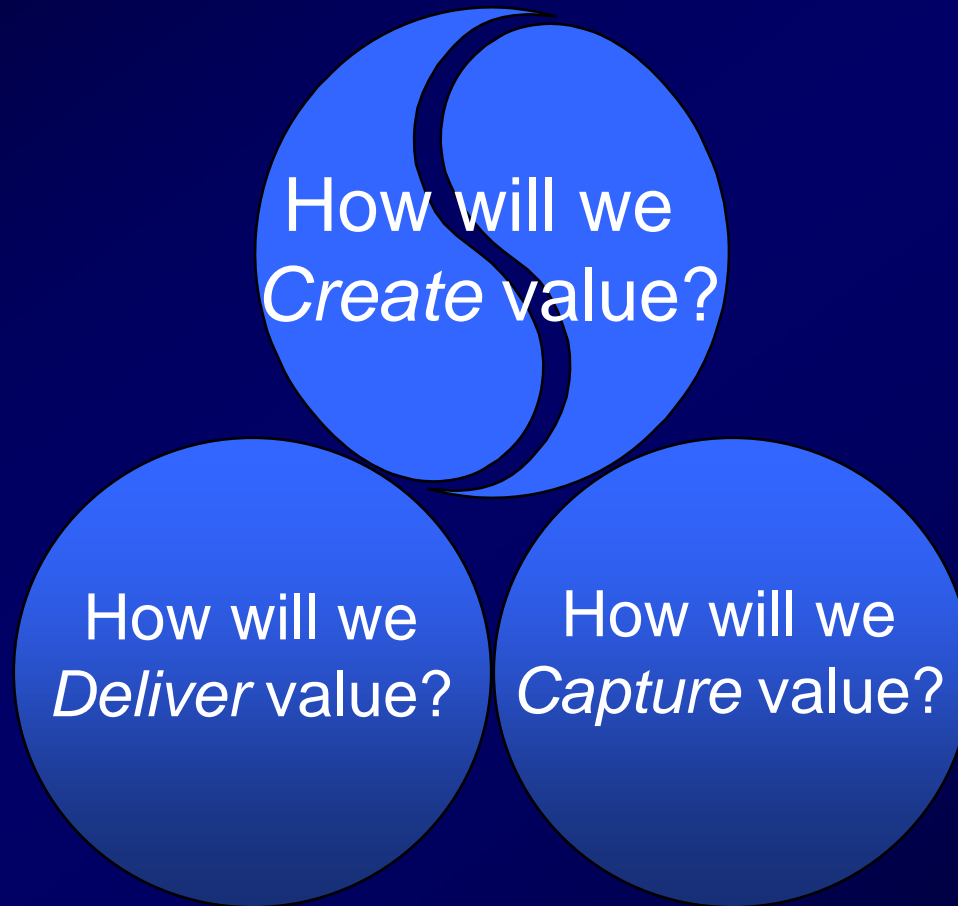


**But they also create major opportunity!**

- Start-up companies**
- Organizational transformation**

**How shall we create value?**

# The first of 3 key questions



# Creating Value:

- Understand how technologies will evolve
  - Both your own and those on which you rely
- Understand how customer needs will evolve
- Develop world class products and services that meet customer needs

# Agenda

- Predicting Technological Change
  - The Delphi Model
  - Trend extrapolation
- Predicting the Evolution of Customer Needs
  - Basic segmentation
  - Crossing the chasm
  - New technologies, new needs

# Can one forecast the path of technological change?

- No

But

- Delphi models
- Trend extrapolation



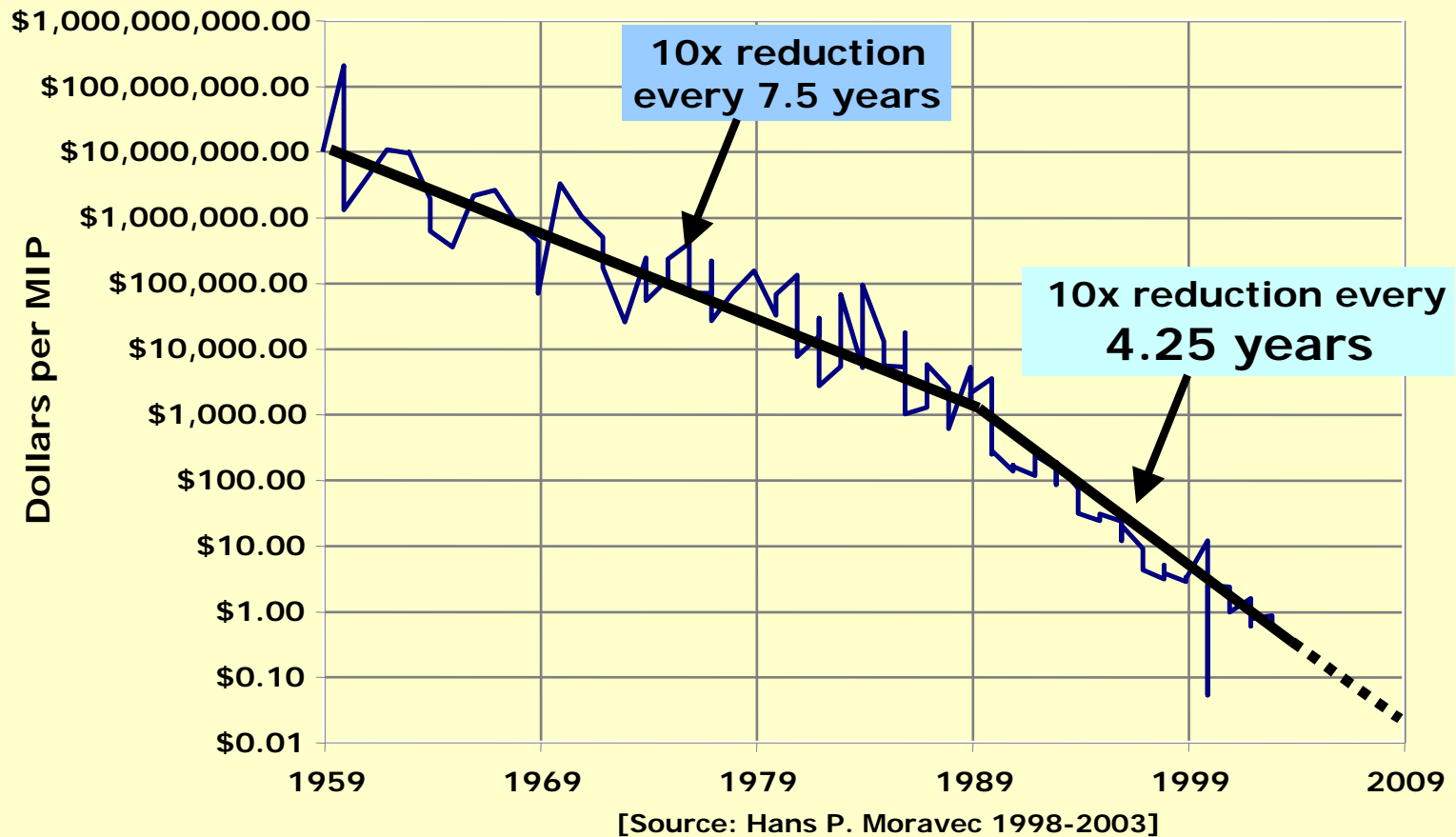
# Delphi Models

- Ask the experts!
  - A committee?
  - Structured questionnaires?
- Pros
  - Field experts are often years ahead of day to day practice: technologies do not “come from no where”
- Cons
  - They sometimes have little knowledge of possible applications
  - They can be enthusiastic

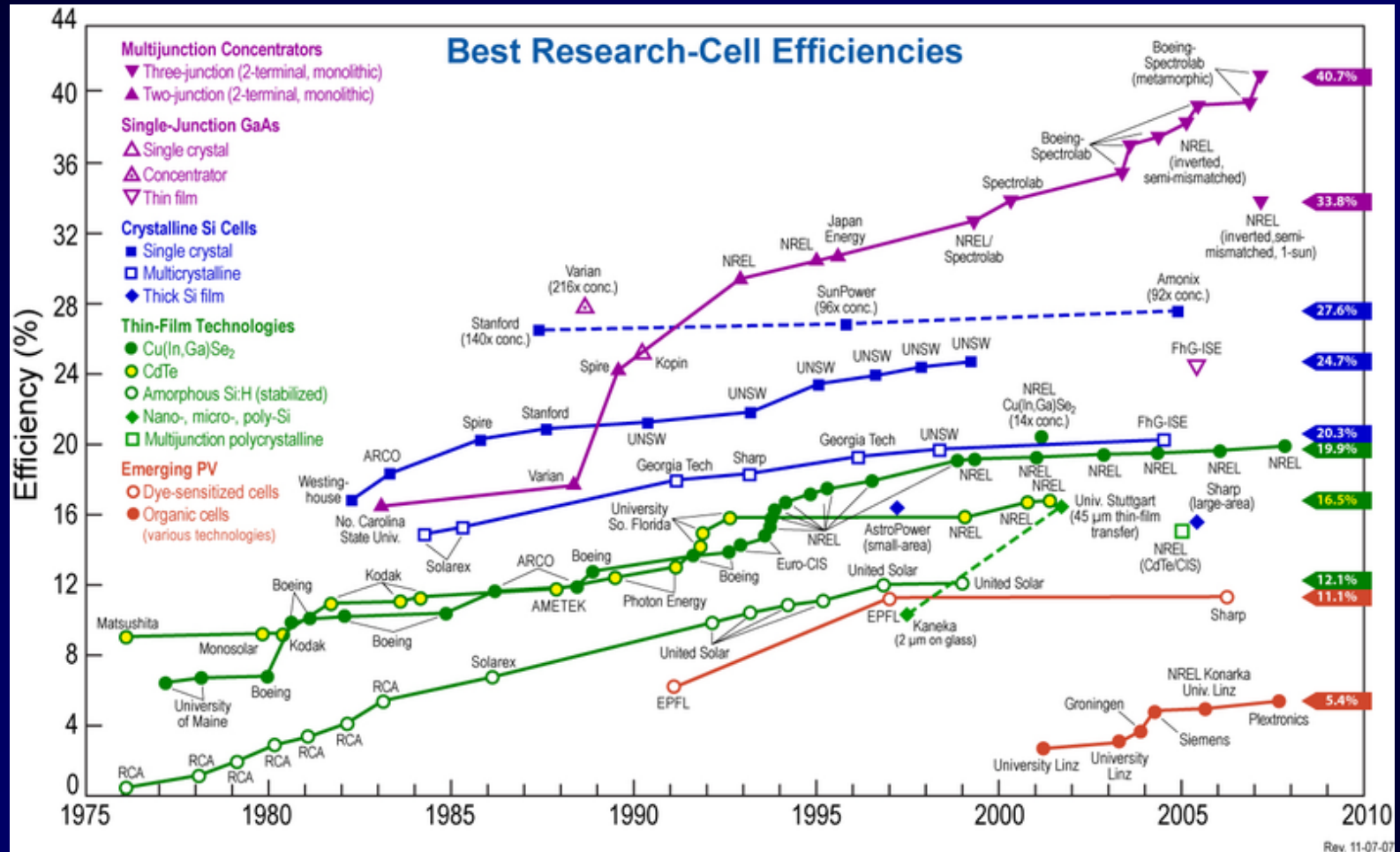
# Trend analysis

- The future is often much like the past, only more so

# Moore's Law at Work



# Solar cell efficiencies s-curves

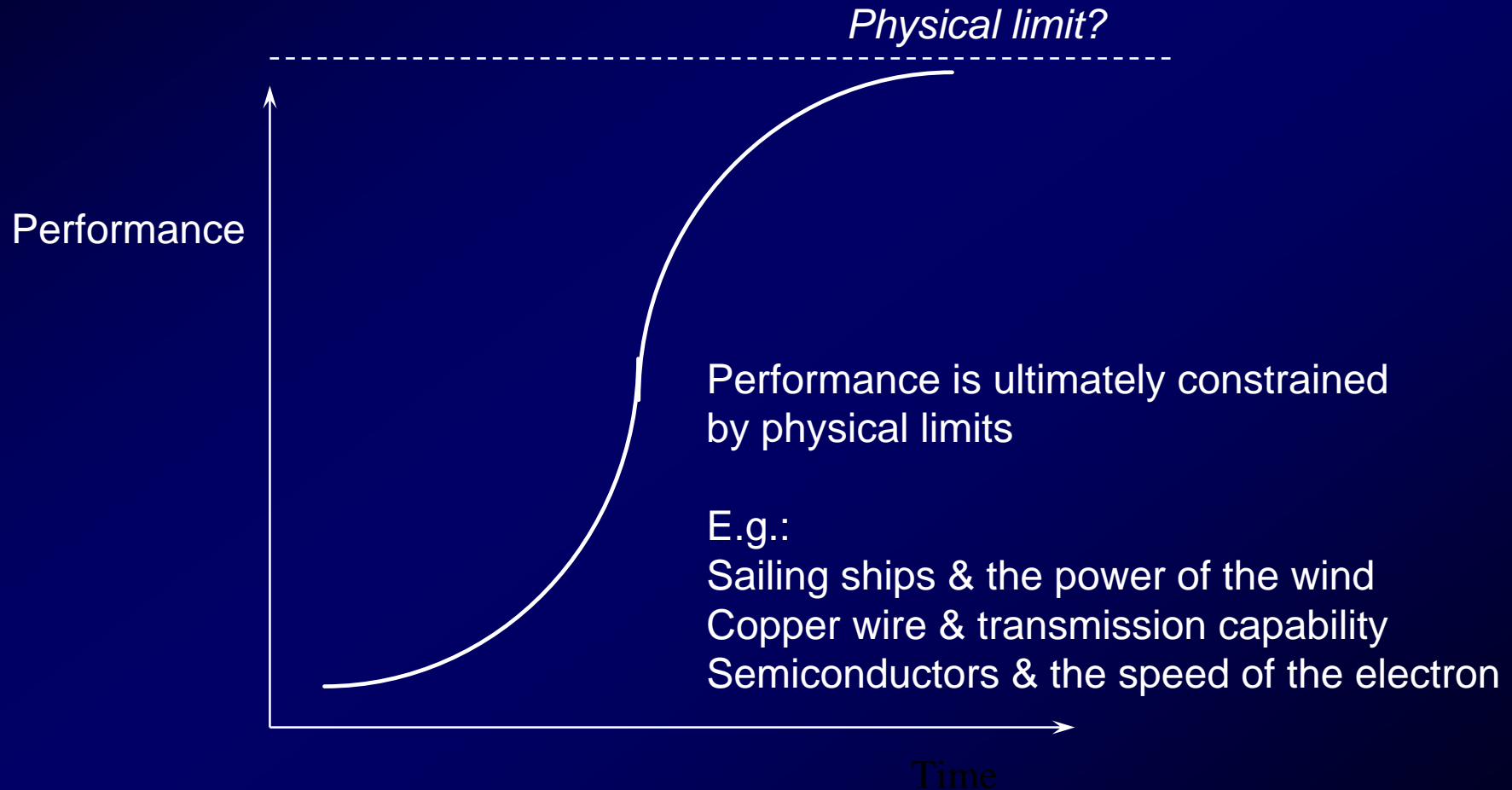


# Issues in Trend Extrapolation

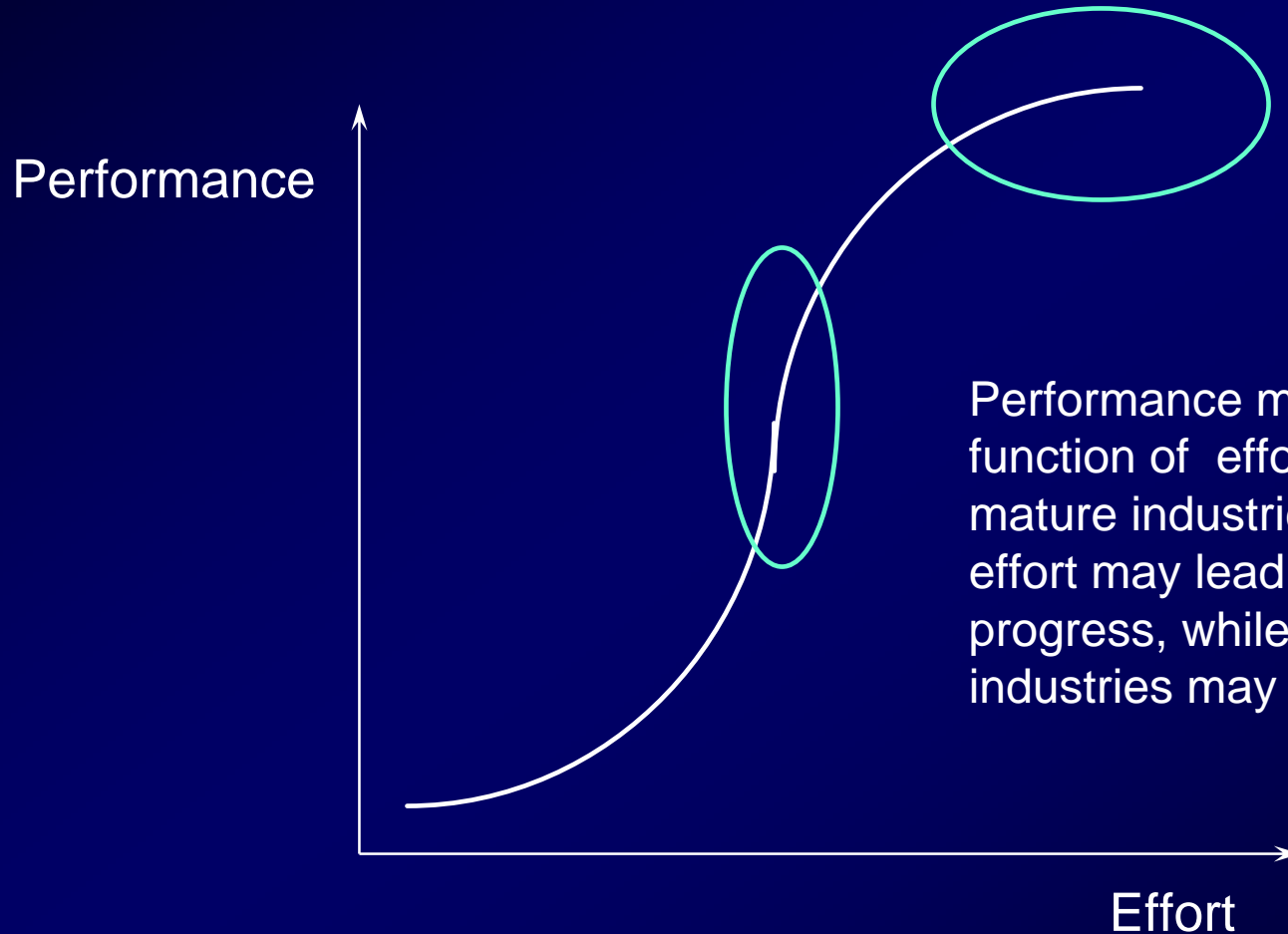
- Which parameter shall I predict?
- Do all good things come to an end?
- Exploring the difference between progress as a result of the passage of time, and progress as the result of returns to effort
- Predicting progress in complementary technologies

# Do all good things come to an end?

## Technological exhaustion



# Modeling the returns to *effort* vs. *time*



Performance may be a non linear function of effort expended: in mature industries more and more effort may lead to less and less progress, while progress in emerging industries may be “surprisingly” fast

# Reflections on the S Curve

- Which unit of analysis?
  - Industry? Firm? Technology? Product?
- Which dimension of performance?
- Effort vs. time?
- Can performance limits be predicted?

*The S curve is best viewed as a tool for triggering discussion, not as a “scientific reality”*



**The Evolution of Markets**

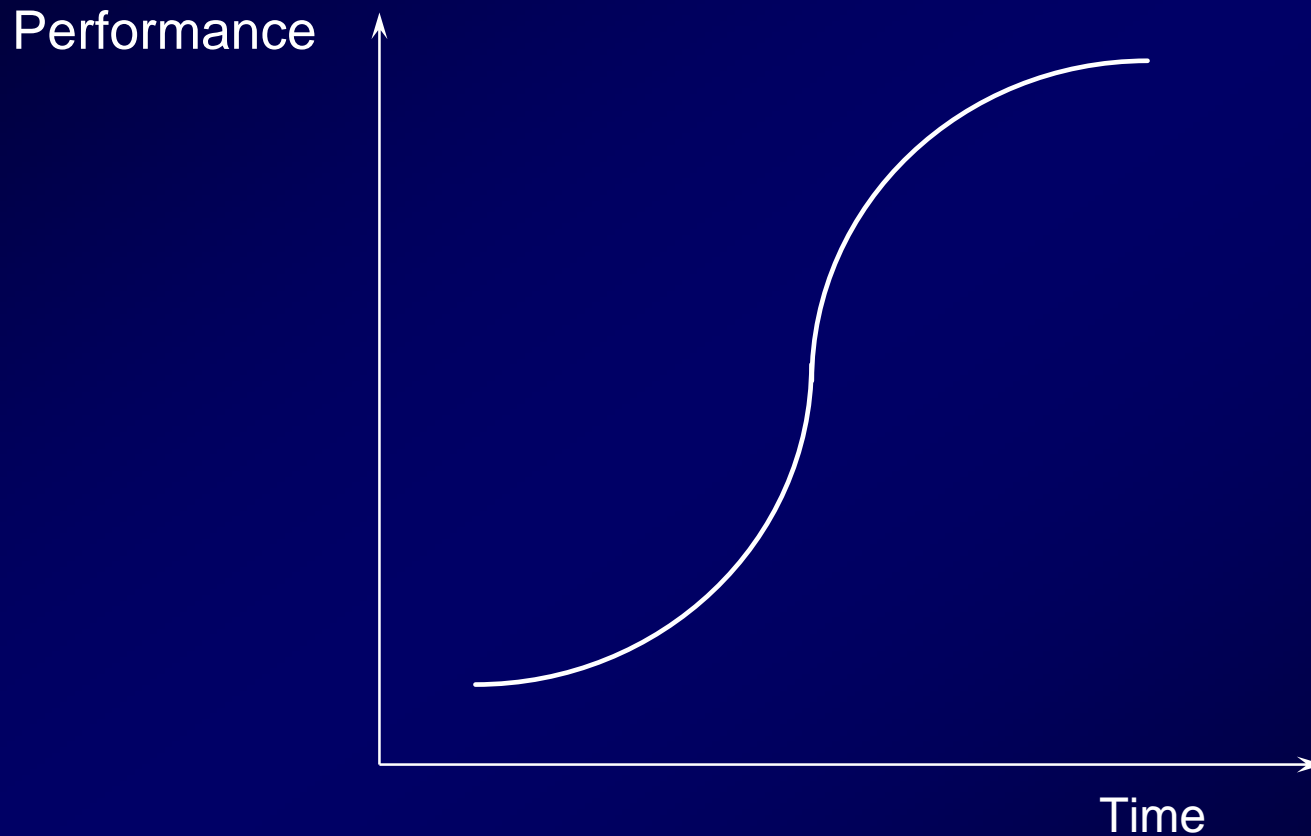
**or**

**Predicting the pattern of  
customer needs**

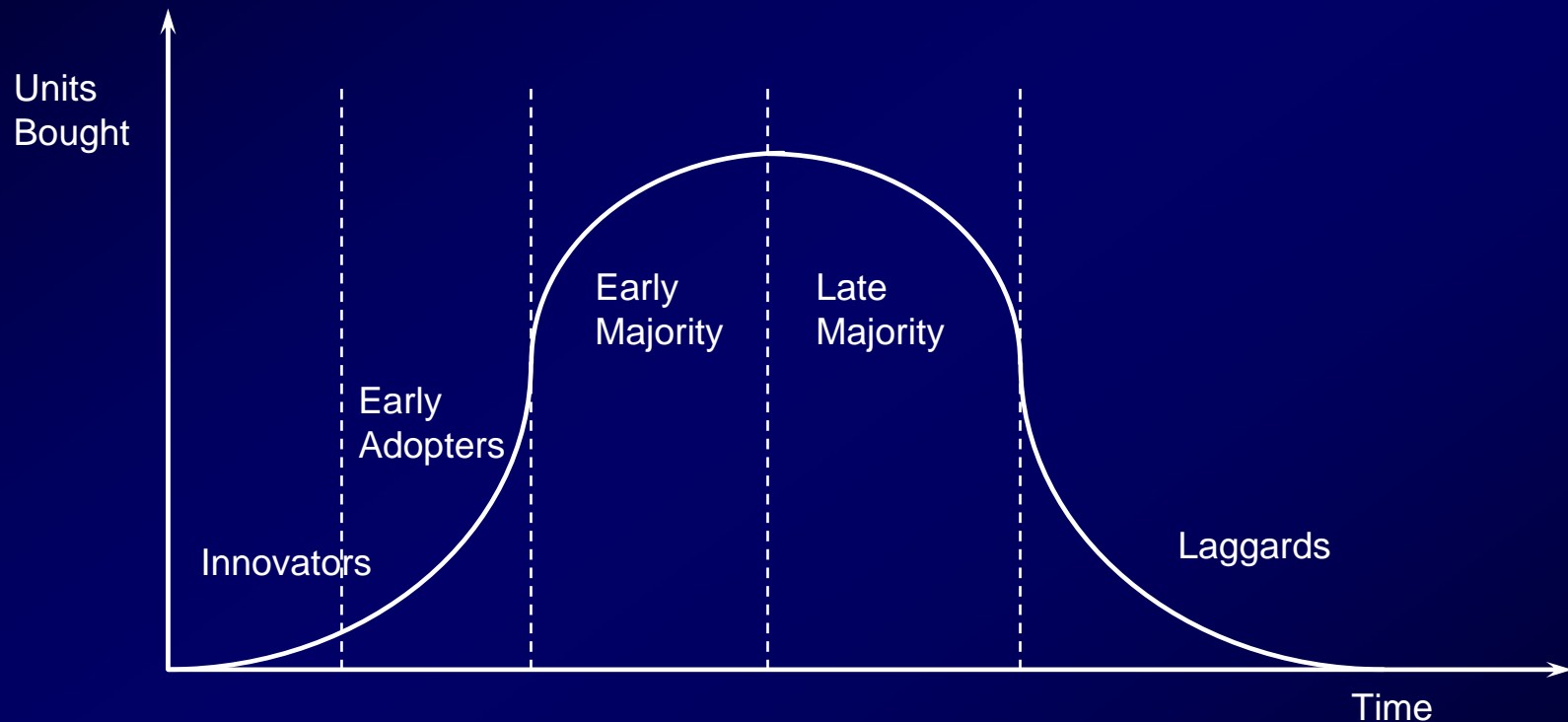
# Market Evolution over the Life Cycle

- Market segmentation
- Crossing the chasm
- New markets, new needs:
  - The Innovator's Dilemma

# The Key Question: Who buys a technology as it evolves?

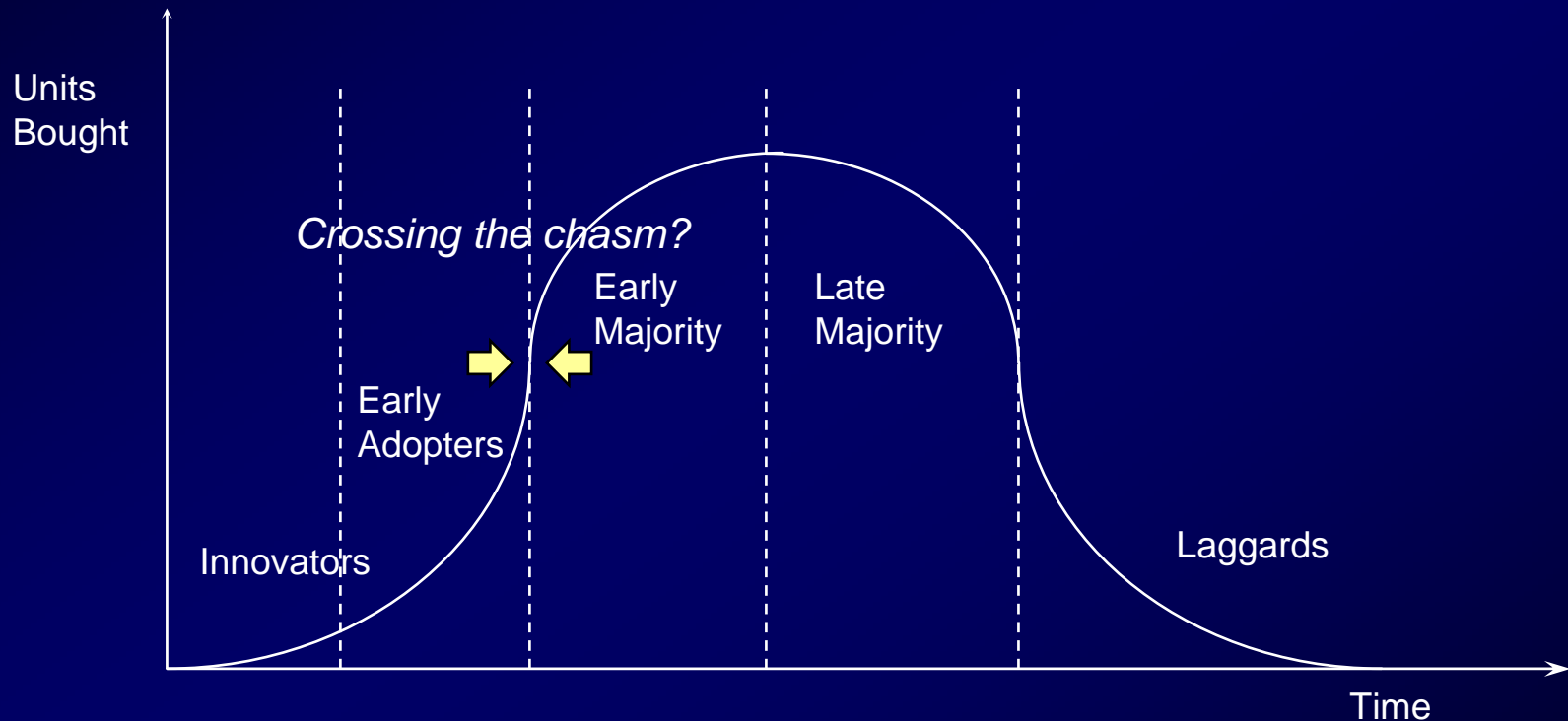


# Understanding market dynamics: Basic segmentation (Rogers)



*Adopters differ by, for example, social, economic status -- particularly resources, affinity for risk, knowledge, complementary assets, interest in the product*

# Understanding market dynamics: Crossing the chasm: (Moore)



*Making the transition from “early adopters” to “early majority” users often requires the development of quite different competencies: e.g. service, support capabilities, much more extensive training.*

## Hybrids have paved the way for plug-in penetration

Consumers have come to appreciate the fuel efficiency advantage of HEVs, providing a springboard for plug-ins (PHEVs and BEVs). The HEV market is also important to the plug-in industry because (1) historical HEV penetration rates provide some visibility on the rate at which the plug-in market may initially develop and (2) li-ion batteries are expected to capture a growing share of the HEV battery market.

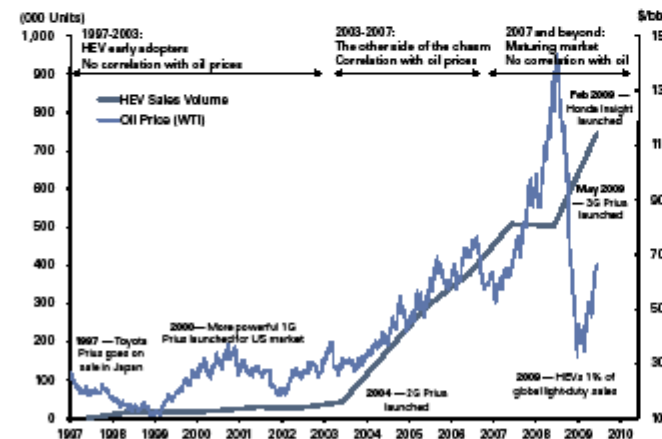
**Light-duty hybrids achieved a 1% market penetration (% of sales) in 2009.** The HEV market crossed the chasm in 2004, about 7 years after the launch of the Toyota Prius in 1997. Hybrid shipments increased dramatically between 2004 and 2009, a time period over which oil prices rose from \$30 per bbl to \$145 per bbl, before dropping back down to their current level of around \$75/bbl. We note that the HEV market is maturing and has now reached the point at which growth is no longer correlated with oil prices.

**We expect hybrids to be 12% of light-duty vehicle sales in 2020.** Our Japan auto team forecasts 0.9 million light-duty HEV sales in 2010, increasing to 2.8 million in 2015 and 12.4 million – or 12% of light-duty sales – in 2020. HEVs have paved the way for plug-ins, so we do not think it unrealistic that the plug-in market could reach the chasm by 2012, with market demand steadily rising between 2012 and 2020.

**We expect plug-ins to be about 4% of light-duty vehicle sales in 2020.** Our Japan auto team forecasts an increase in PHEV sales from 10,000 units in 2010 to 2.0 million in 2020, 2% of global light-duty sales, and an increase in BEV sales from 20,000 units in 2010 to 1.7 million in 2020. We caution that plug-ins are still approaching the chasm, with the timing, level, and pace of adoption uncertain.

**Exhibit 30: HEVs have crossed the chasm.....**

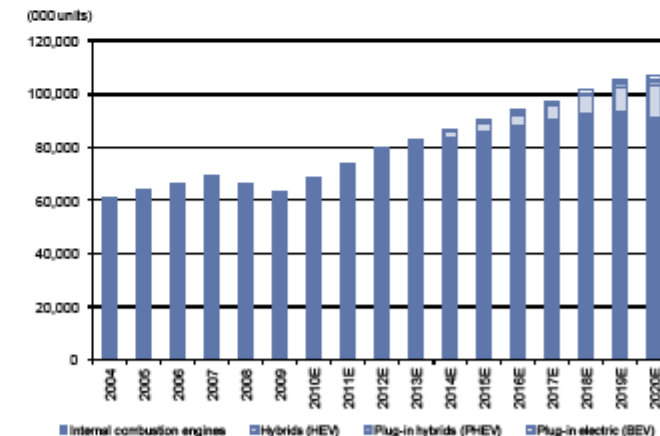
Hybrid sales and crude oil prices



Source: MarkLines, Datastream.

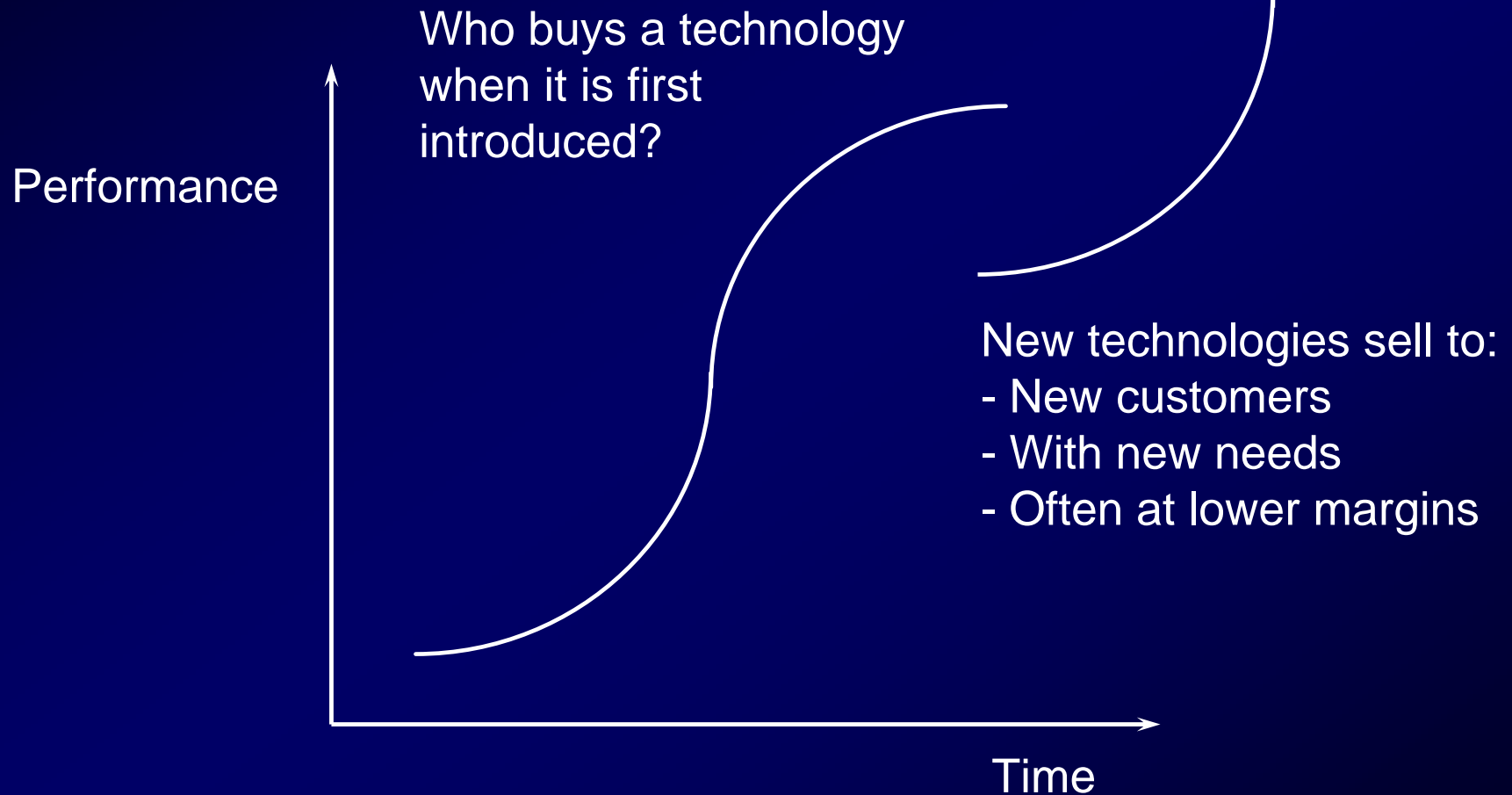
**Exhibit 31: Paving the way for gradual plug-in penetration**

Light-duty auto sales

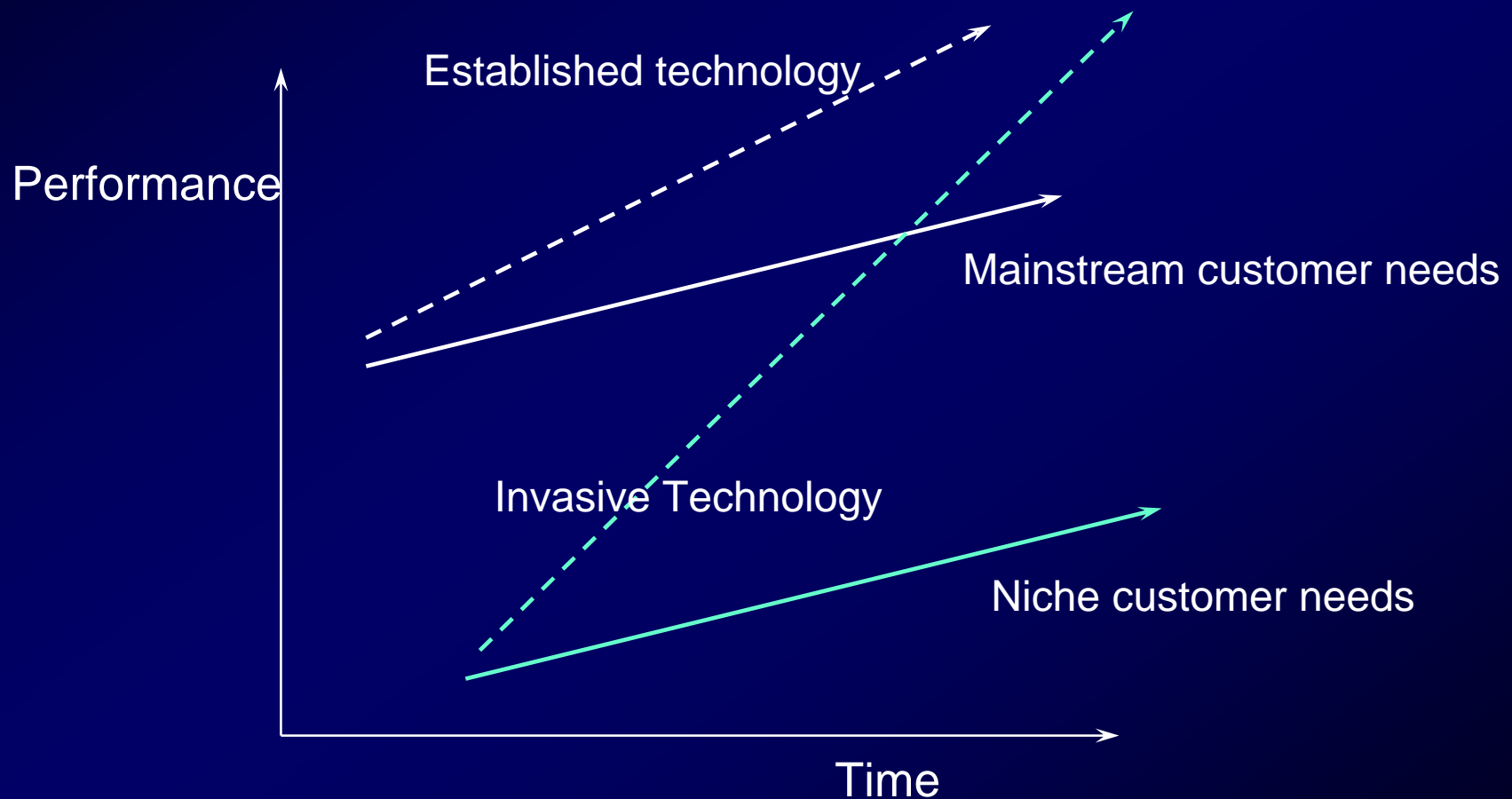


Source: Global Insight, MarkLines, Company Interviews, Goldman Sachs Research.

# Managing customers at moments of discontinuity at established companies

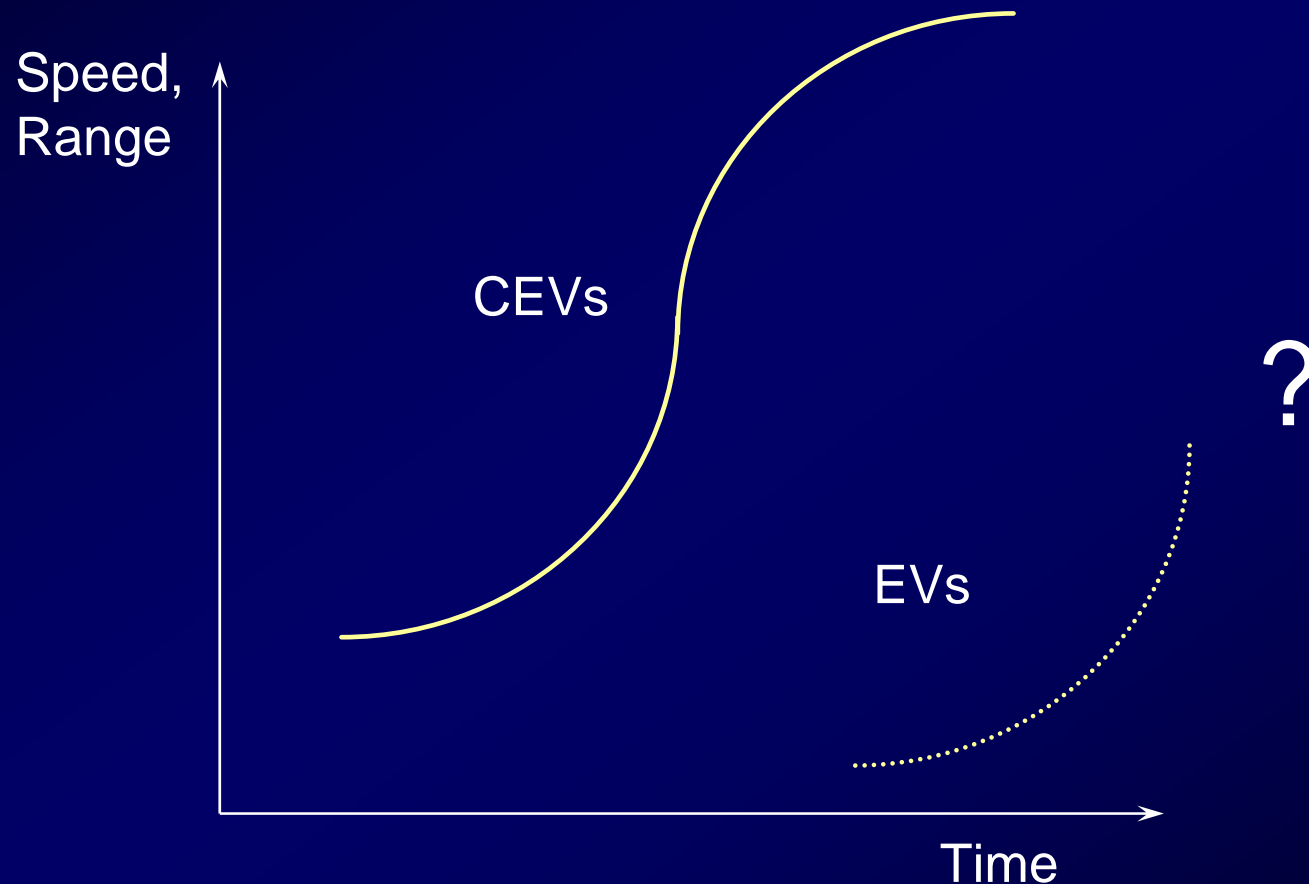


# The Innovator's Dilemma: “Disruptive” technologies may threaten established firms

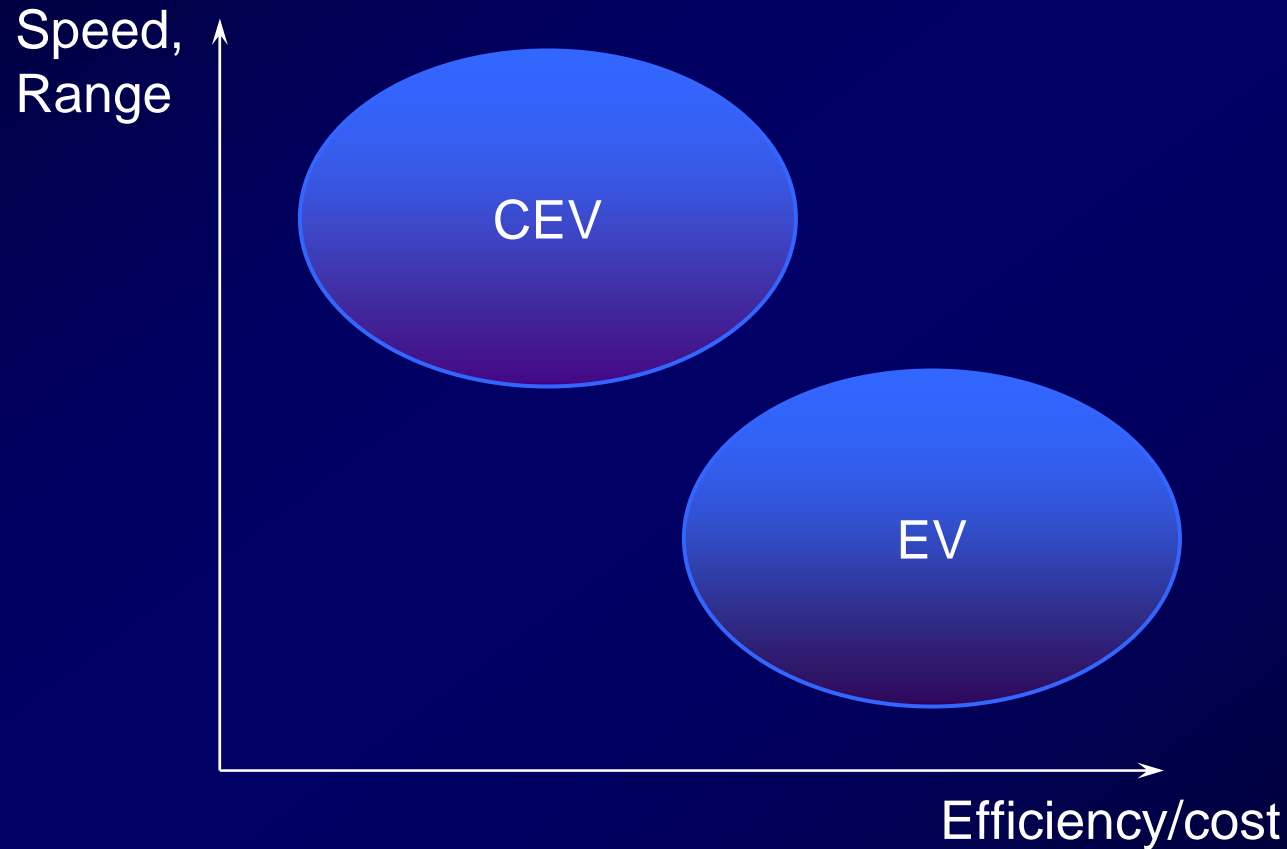




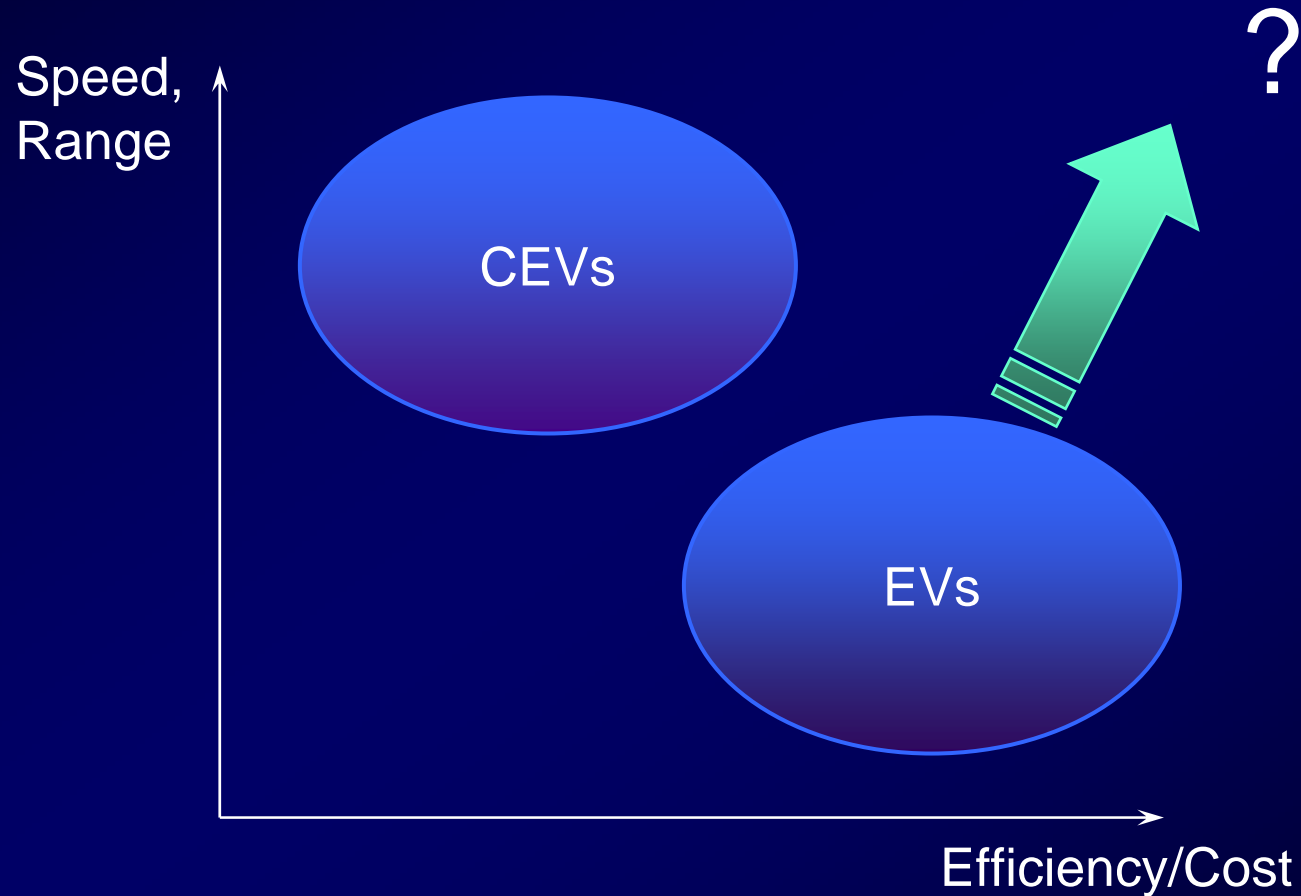
# Initially, EVs do not seem to be a threat to Combustion Engine Vehicles:



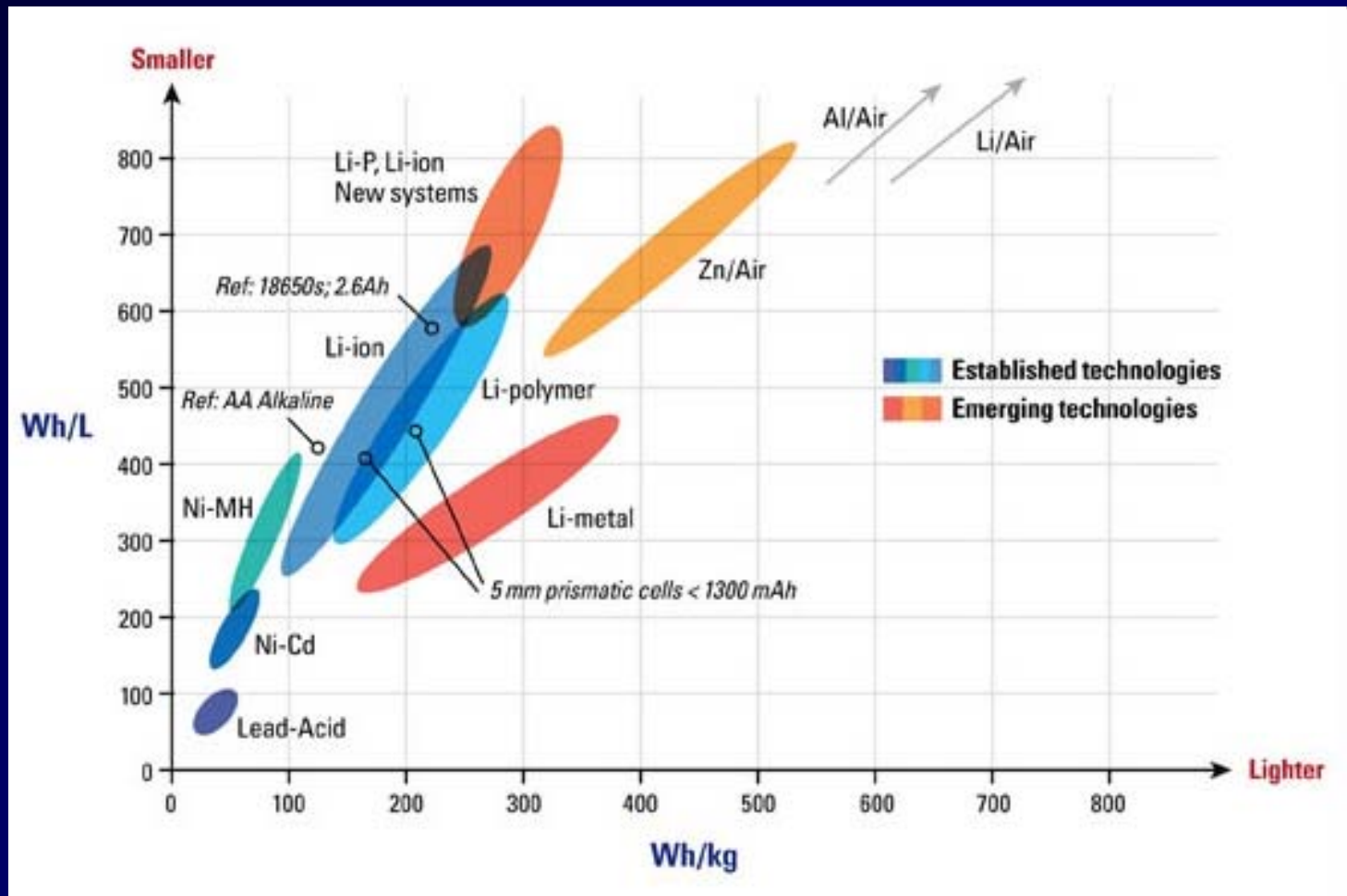
# EVs sold to customers with different needs:



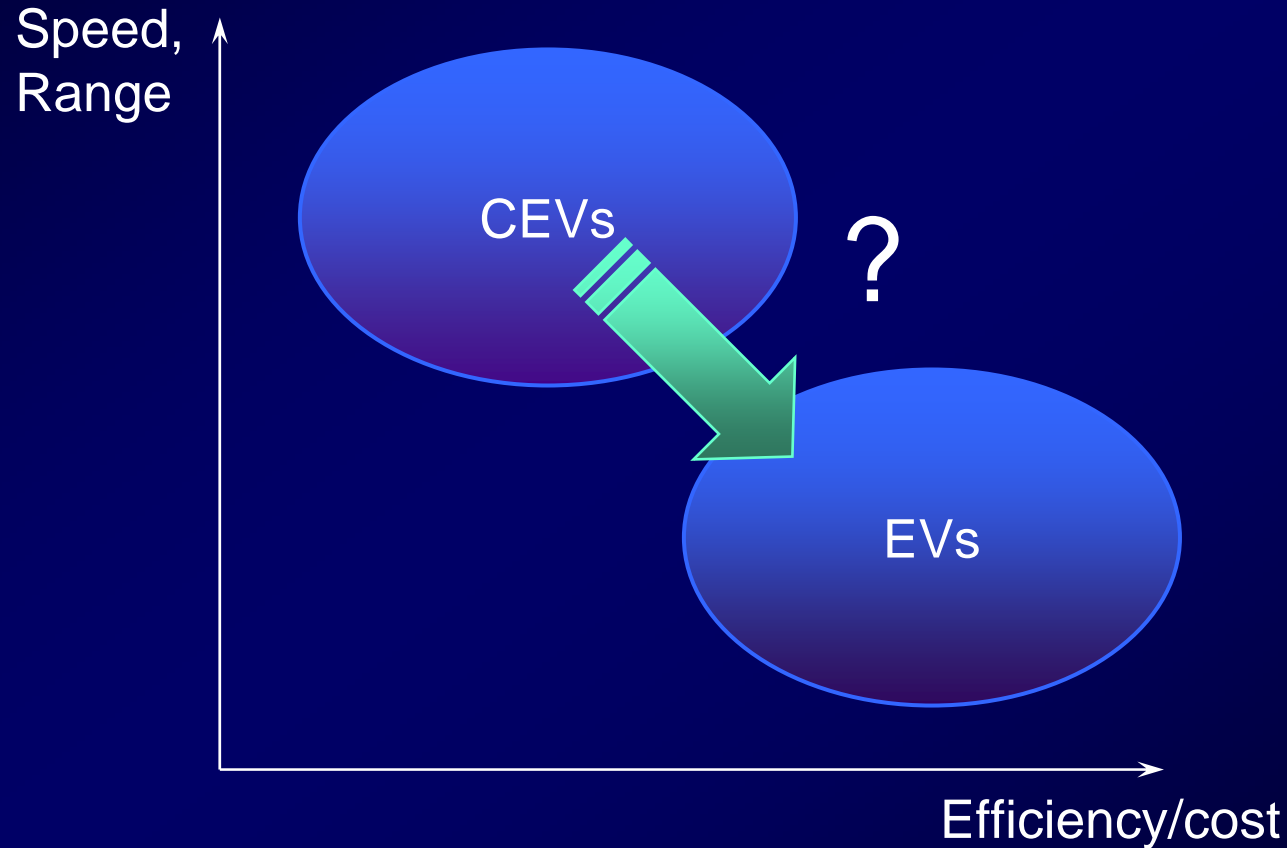
# But as EVs improve they may come to challenge CVs



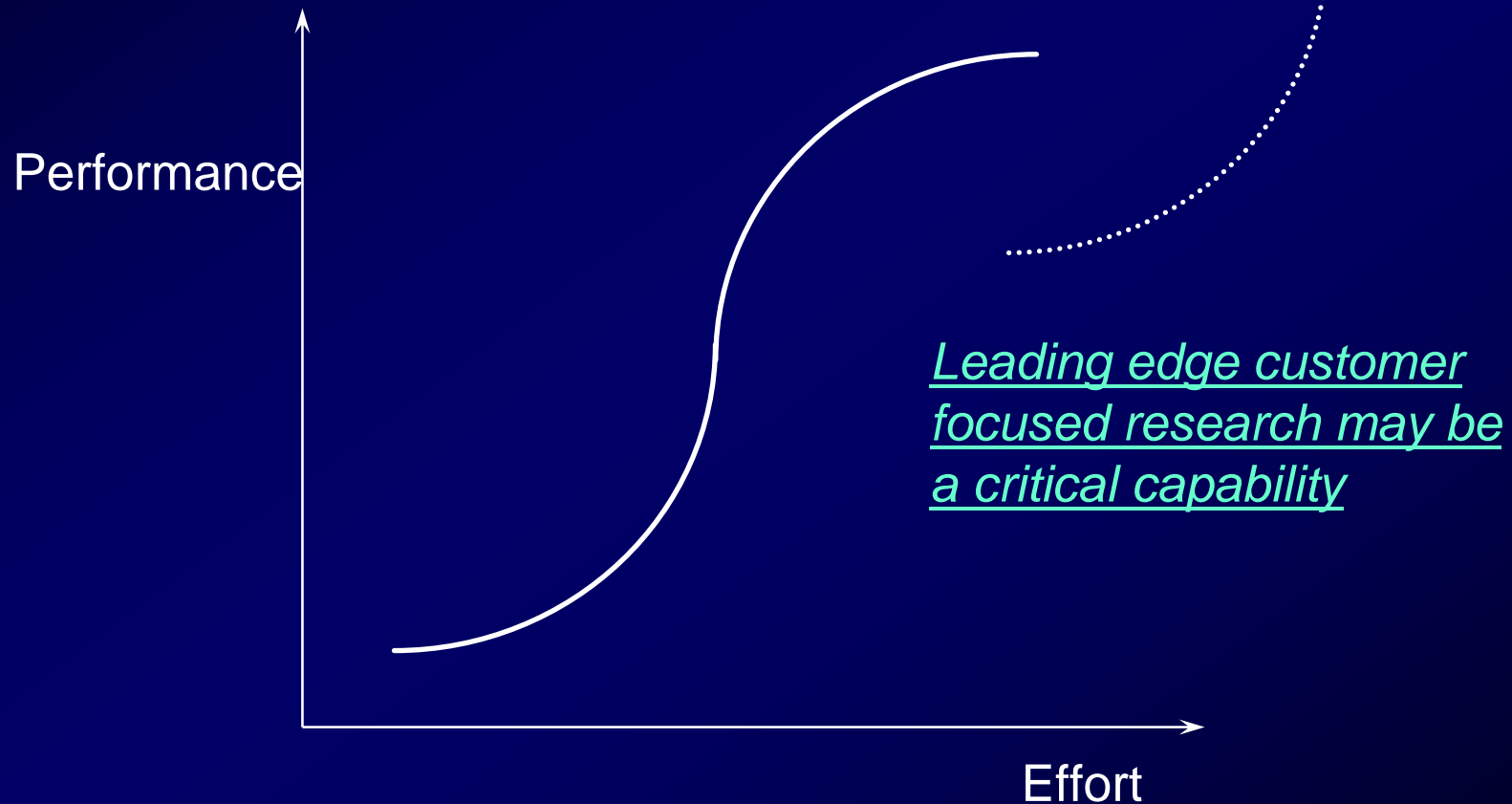
# Technological developments batteries



# Or consumer preferences may change



# Managing the change in customer groups may be the hardest task! Especially for established companies



# What can be done?

- “Ready, aim, fire”
- Small scale experiments
- Market research of all kinds:
  - Conjoint analysis
  - Direct customer contact
  - Virtual products
  - Lead user research
- Significant resources required?

# Creating Value:

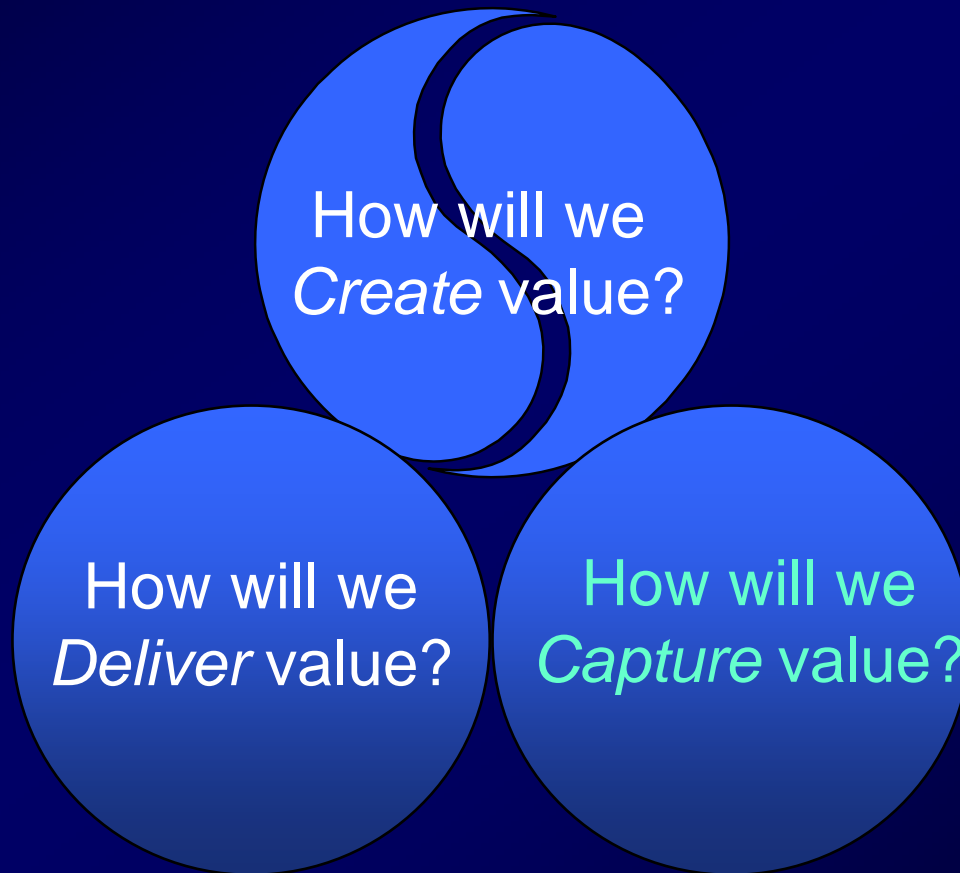
- Understand how customer needs will evolve
- Understand how technologies will evolve
  - (Both your own and those on which you rely)
- Develop world class products and services that meet customer needs



# **How shall we capture value?**

Uniqueness, Complementary Assets &  
the Structure of the Value Chain

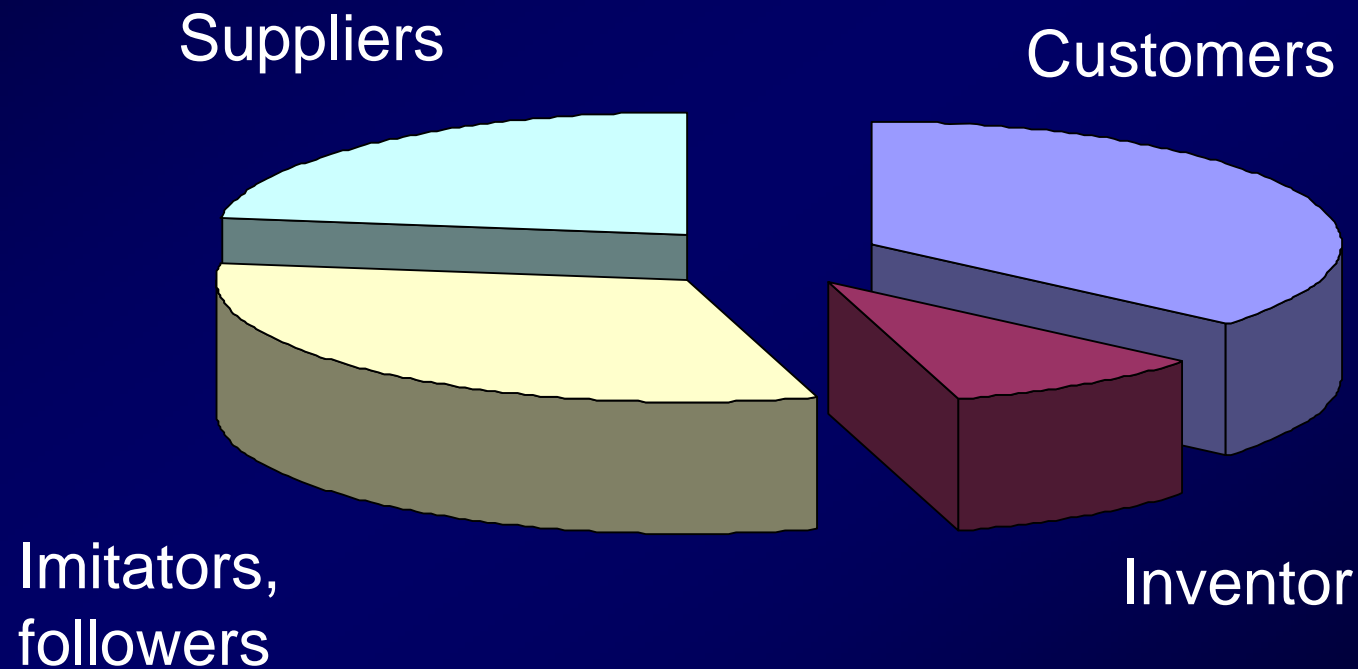
# The second of two key questions:



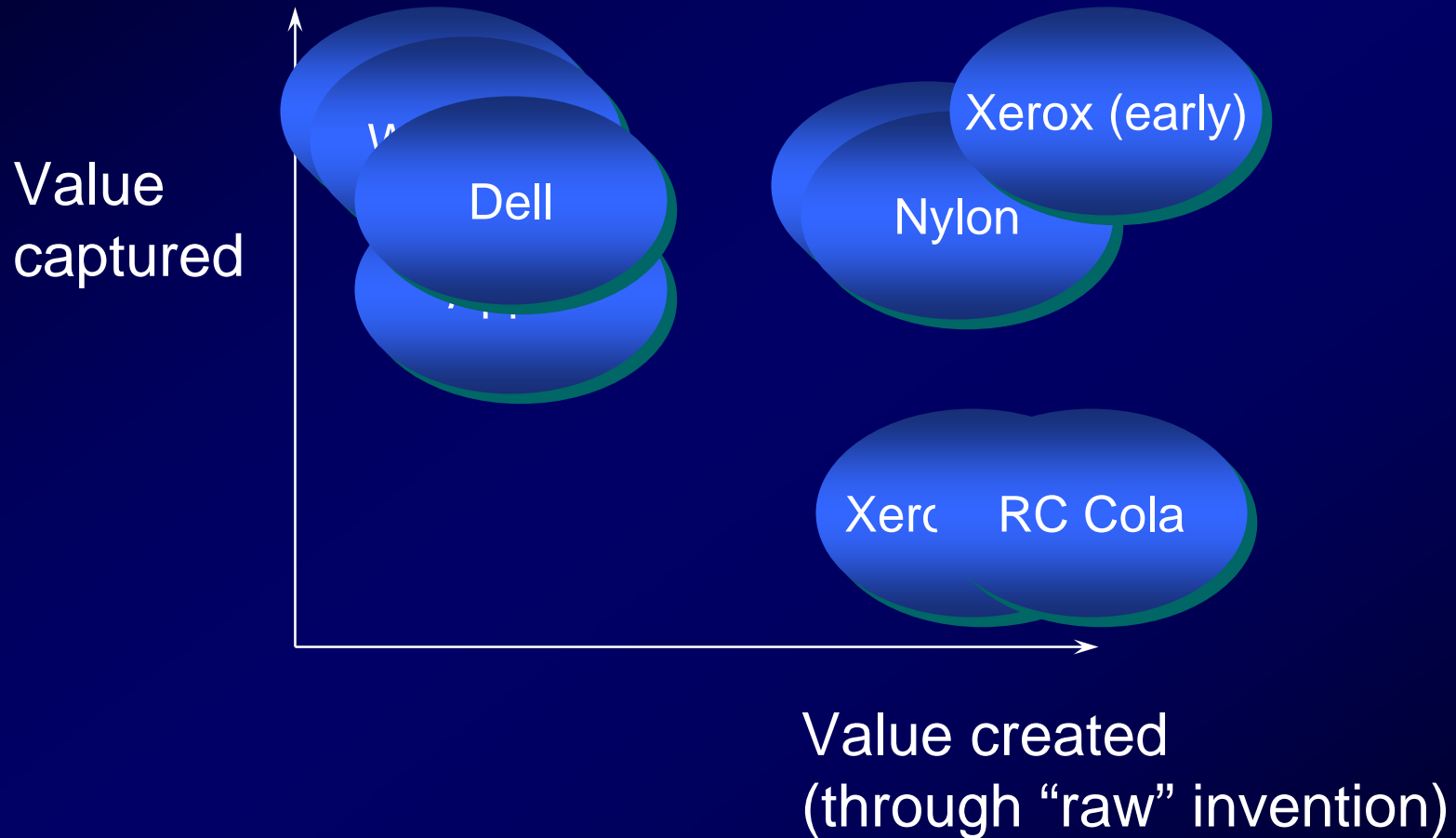
# How shall we capture value?

- **How should we design the business model?**
- (Where should we compete in the value chain?)
- How should we compete if standards are important?

# Or: What determines the Inventor's Share?



# Is it the case that great ideas = pots of money?



# Three key ideas:

- **Uniqueness**
  - *Controlling the knowledge generated by an innovation*
- **Complementary assets**
  - *Controlling the assets that maximize the profits from innovating*
- **Understanding the dynamics of the value chain**
  - Should we buy our suppliers? Distributors?
  - Should we outsource our manufacturing... distribution... sales... capability?

# Uniqueness is very important:

- If a particular innovation, or the knowledge on which it rests, can be completely “appropriated” (i.e., completely controlled or protected) then the innovating firm may be able to maintain a unique position. This is a tremendous source of bargaining power.

# Sources of Uniqueness

- Intellectual property protection
  - Patents
    - Finite length
    - The right to prohibit “producing”
  - Copyrights
    - The right to prohibit “copying”
- Secrecy
  - Trade secrets & non compete clauses
  - “Tacit” knowledge
- Speed



# So

- It is critically important to proactively develop an IP strategy that is tightly integrated to the strategic goals of the business
- But...

# Uniqueness is powerful but often difficult to maintain

- Legal mechanisms can be costly to create, and then even more costly to enforce: and sometimes they require public disclosure
- Secrecy may be difficult to maintain
- Speed is hard work, and sometimes imitable

# What are Complementary Assets?

- Those assets that allow a firm to make money, even if the innovation is not unique:
- The answer to the question:
  - If our innovations were instantly available to our competitors, would we still make money? Why?

# In the best case, complementary assets should be *tightly held*

- Complementary assets that are tightly held are not easily available to entrants or to most competitors

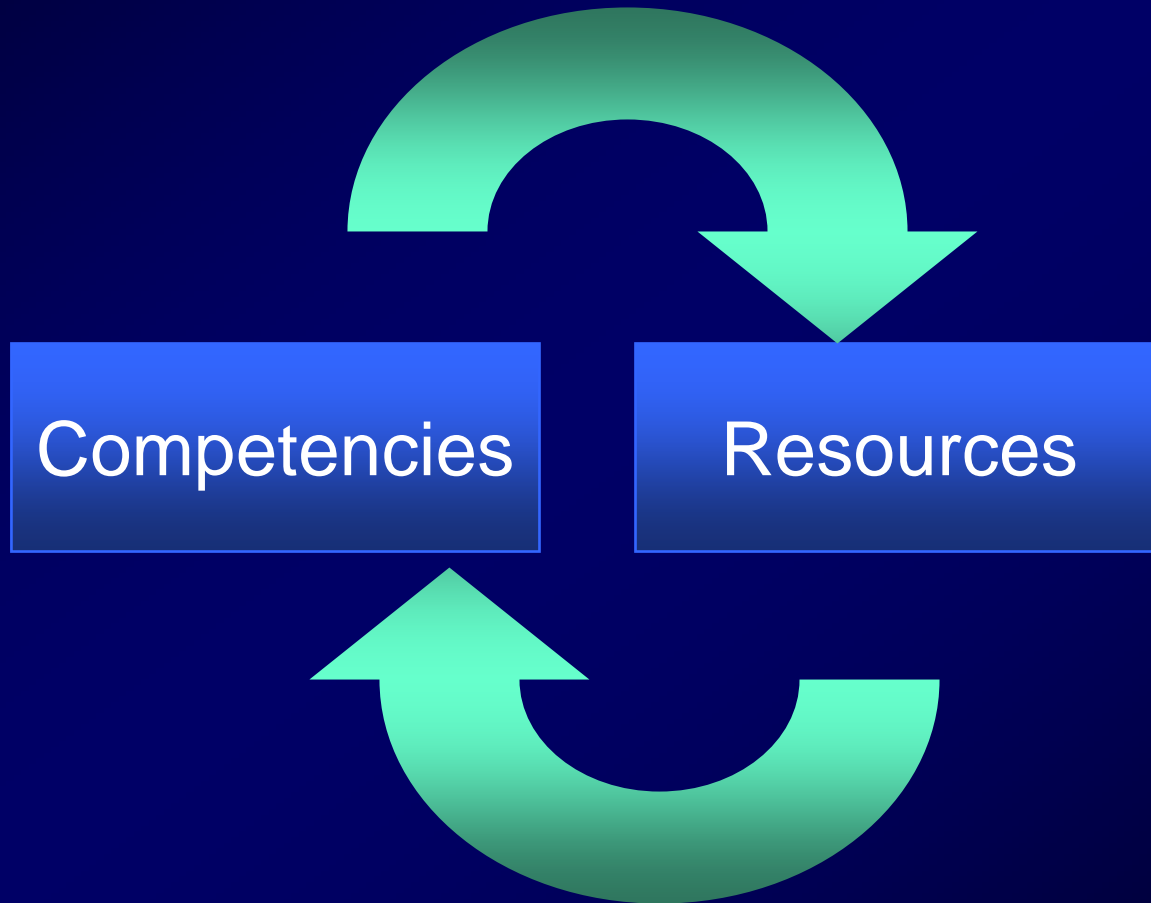
# Types of Complementary Assets

- Things you can do
  - Manufacturing capabilities
  - Sales and service expertise

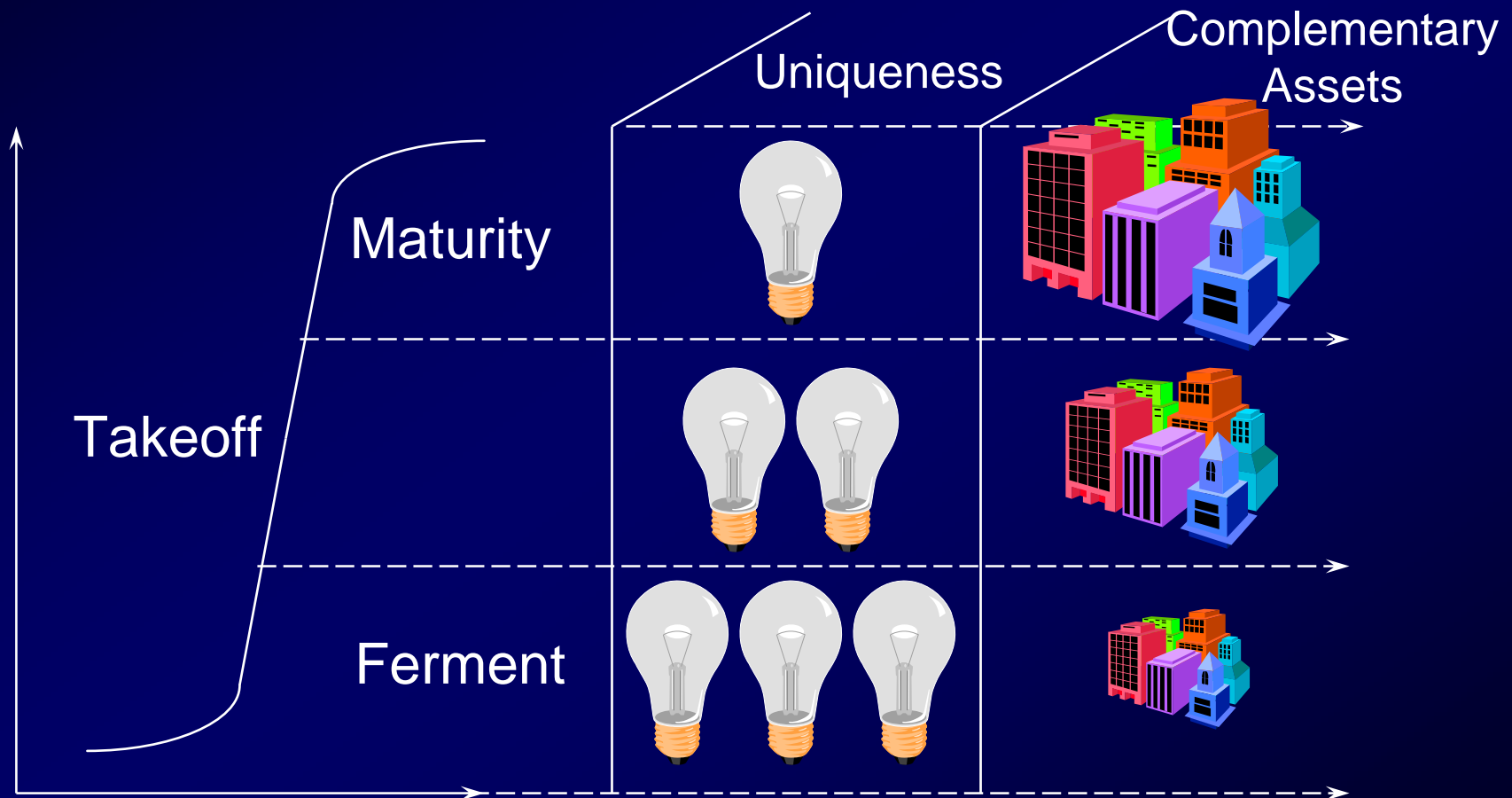
} **COMPETENCIES**
- Things you own
  - Brand name
  - Distribution channels
  - Customer relationships

} **RESOURCES**

**In successful firms, competencies  
create resources, and vice versa:**



# Uniqueness & Complementary Assets over the Life Cycle:



# Uniqueness & Complementary Assets: Strategic Imperatives

- Defend uniqueness if possible and appropriate
- Build complementary assets in advance of competition
- At moments of discontinuity ask:
  - Are my complementary assets useful?
  - If so, which ones?



# How shall we capture value?

- How should we design the business model?
- Where should we compete in the value chain?
- **How should we compete if standards are important?**

**Standards and Strategy:**

**Competing in Increasingly  
Open Worlds**

# What is a standard?

- A standard is a specification that allows for interoperability
- Eg:
  - Cups and lids
  - Pistons and engines
  - Telephones and sockets
  - Speakers and amplifiers
  - Hardware and software

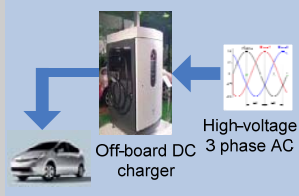
# Standards in EVs

kVA

Charging Time

180 - 400

5 – 15 min



Fast



Battery exchange station

10 - 25

1 – 3 h



Medium/Semi-fast

- 3 Phase AC
- 230V
- 32 or 63 A

1 - 5

6 h



Normal/Slow

- 1 Phase AC
- 230V
- 16 or 32 A

## conductive charging system - compatibility of different modes and cases

CPL mode	situation / power*	vehicle inlet / connector	cable and wall / infrastructure	CPL	architecture	for mode
1	domestic up to 16A	1-phase 3.7kW none / IEC 309-2 compatible 3-phase 11kW none /	resistive coding via Power Indicator national plug and socket systems	no control pilot signal	power contacts	4/5
	IEC 309-2 up to 16A	1-phase 3.7kW none / 3-phase 11kW none /	IEC 309-2 plug and socket system		signal pins	2-5
2	unspecific up to 32A	1-phase 7.4kW none / 3-phase 22kW none /	in-cable protection device unspecific outlets (IEC 309-2 32A devices included) provides control pilot	no control pilot provided by wall equipment	only mains AC	1-3
3	dedicated up to 32A	1-phase 7.4kW none / 3-phase 22kW none /	case B up to 32A	control pilot according SAE 1772	mains AC and high power DC	1-4
	dedicated up to 63A	1-phase 14.5kW	AC, DC or / and high power AC charging station		mains AC and high power AC	1-3, 5
4	DC up to 400A		mains AC	90% duty cycle		
U.C.	high power AC up to 250A		DC quick charging high power AC			

\* maximum power at IEC recommended standard voltage 230V/400V

file: IEC TAB1 SCH application: PROTEL for WINDOWS 2.2 date: 15-04-96 drawn by Arno & Axel

# Questions:

- What is a standard?
- What are switching costs?
- What are network effects?
- What is positive feedback?
- What does increasing returns mean?  
What does it mean when a market “tips”?
- What is lock-in?
- What is the significance of “winner-takes-all”?

# Answers:

- A **standard** is a particular interface, format or system that allows for **interoperability**
- **Switching costs** are incurred when a customer changes from one supplier or marketplace to another. The greater the costs, the more difficult it is to switch
- A product or technology benefits from **network effects** or **network externalities** if a significant part of its value to a consumer lies in the size of its (actual or anticipated) installed base, or market share
- **Positive feedback** involves a chain of consequences that produces a dynamic outcome by feeding off itself – an **amplification** effect
- Success becomes self-reinforcing with **increasing returns to scale**. Demand creates further demand
- If consumers believe that one **standard** is going to capture a very large share of the market, and that a competing **standard** is not viable, then the market will “**tip**” towards the more successful **standard**
- **Lock-in** occurs once a market has **tipped**. **Switching costs** may be high, and it is therefore difficult to get a market to tip to an alternative standard

# Outline

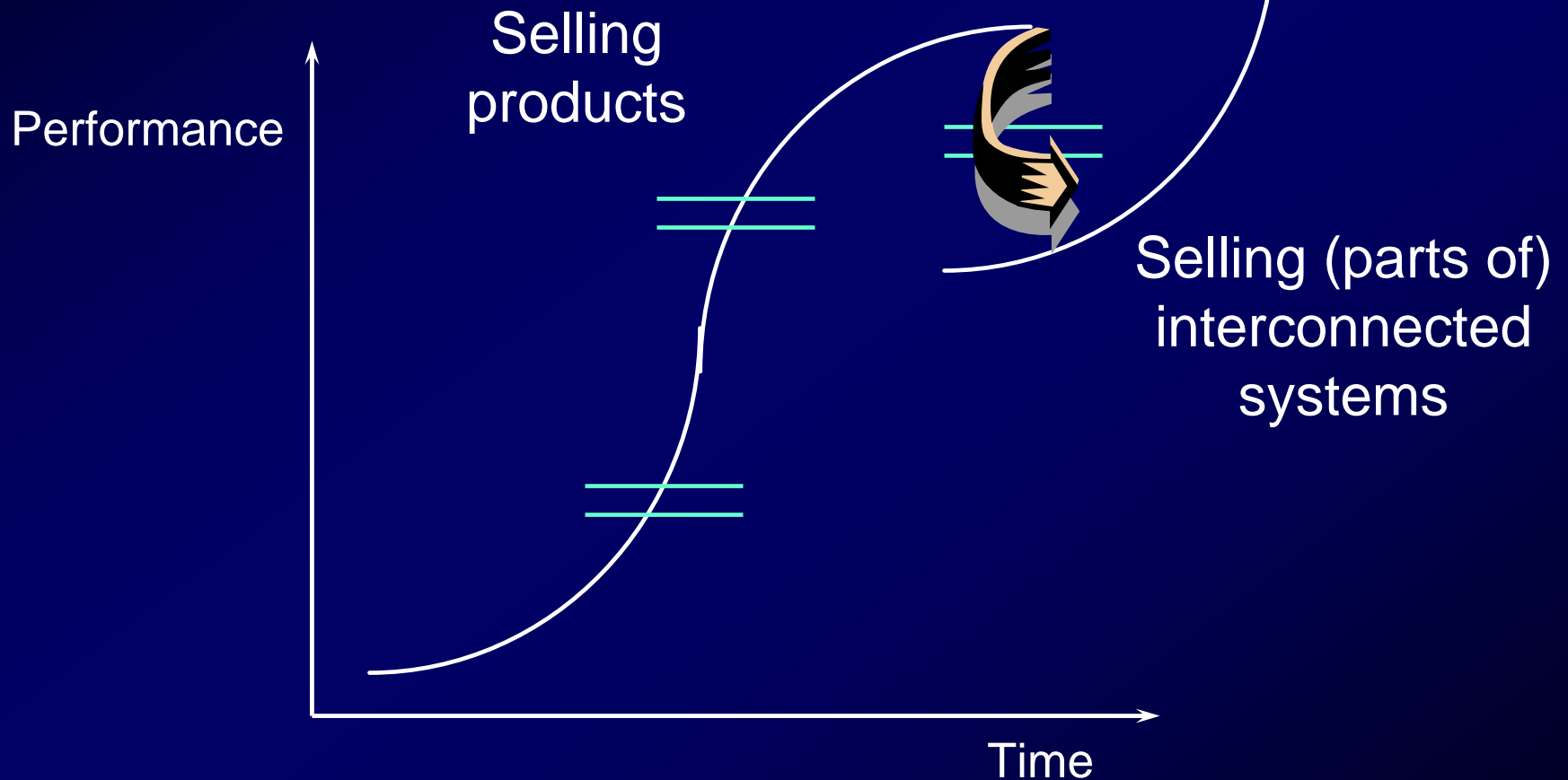
- Moving from “product” to “systems” competition
- Coming soon to an industry near you: the push for public open standards
- Will all markets “tip”? – managing the complexity of standards evolution
- Making money in an open world

# It's not just about software

- Bicycles
- Financial and payment services
- Health care
- Automobiles



# The challenge



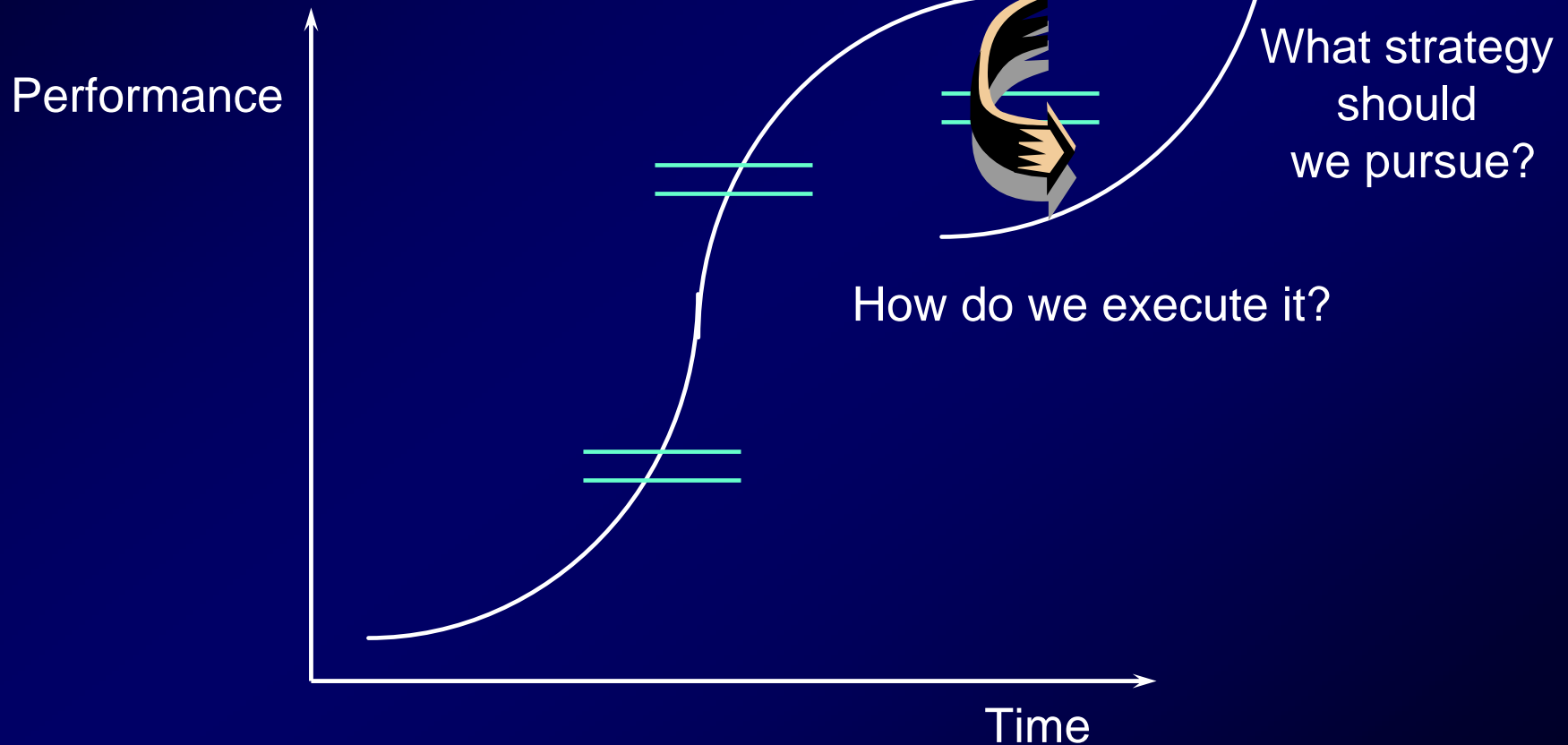
## Selling Products

- Customers who care about products “on their own terms”: is this the right product for me?
- Build the “best” product
  - Best designed
  - Lowest cost
  - Most reliable

## Selling Interconnected Systems

- Customers who care about the total system experience: will this connect with the rest of my world?
- Control the architecture  
Or
- Influence the architecture and build the best products within it

# These transitions raise both strategic and organizational questions



# **The push for public open standards**

# Thinking about the dynamics of the strategic space

Access is:

Open

Closed

Public

Details of standards are available to all: no single firm has control over how they evolve: no charge for their use

E.g. TCP/IP, HTML

Standards are owned and controlled by the public sector but are not freely available

E.g. Cryptography

Control is:

Private

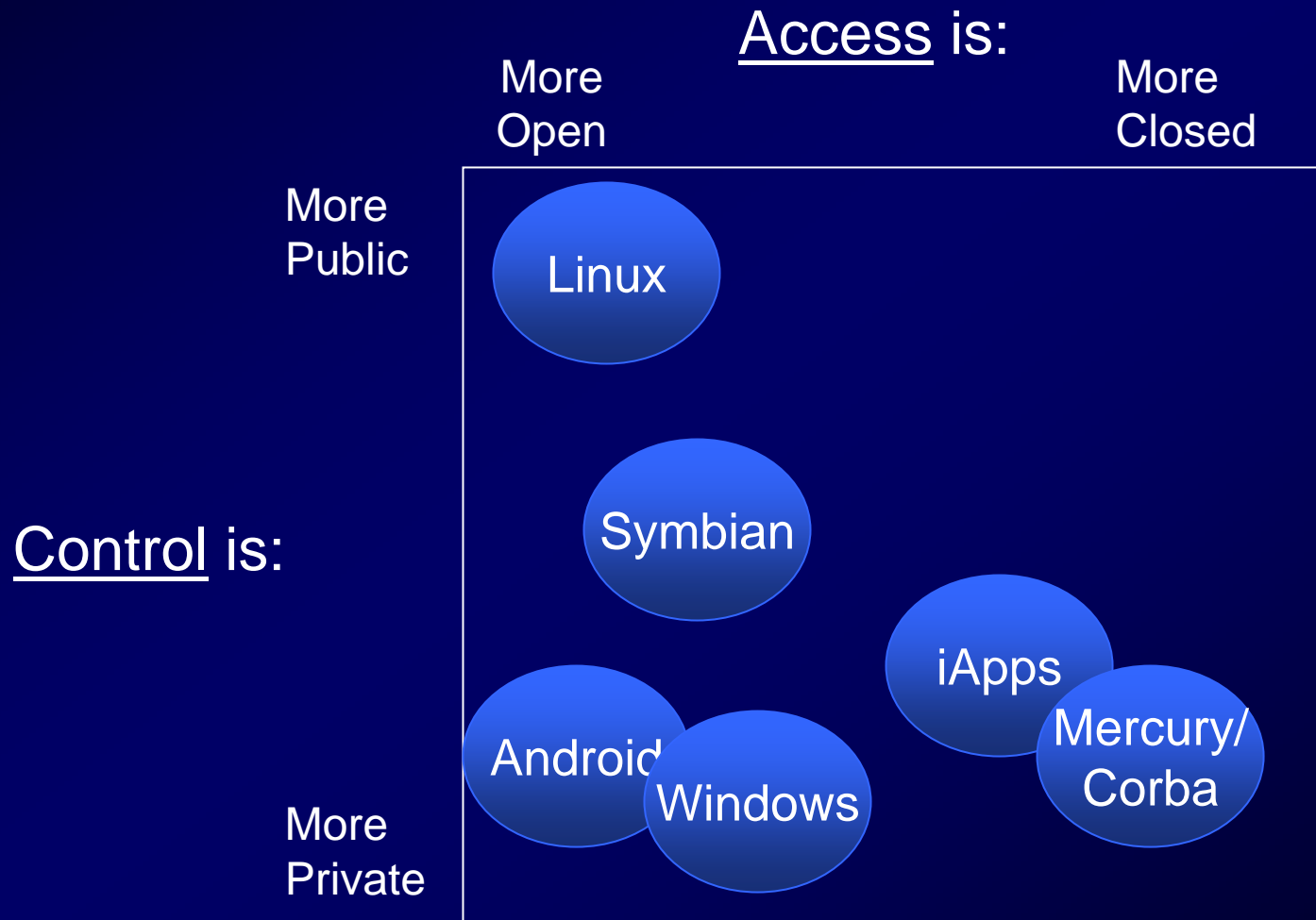
Details of standard are made available to all: but owner has control over how the standard evolves and may charge for use

E.g. Nintendo, Palm OS

Technology may be standard, but details are not made available beyond the firm

E.g. Landmark Graphics, IBM 360

# In practice these boundaries are fuzzy:



**Will all markets tip?**

Or:

Getting a standard established

# Tipping

- Markets “tip” when one standard becomes the preferred choice of nearly every consumer
  - VHS
  - Windows on the PC
- Not all markets tip: in some markets multiple standards co-exist
  - UNIX vs. Windows on servers
  - Sony vs. Microsoft in video games
  - Android vs. Windows vs. iPhone in Smartphones
  - Multiple standards in cellular phones



# “Great products” vs. “Architectures”

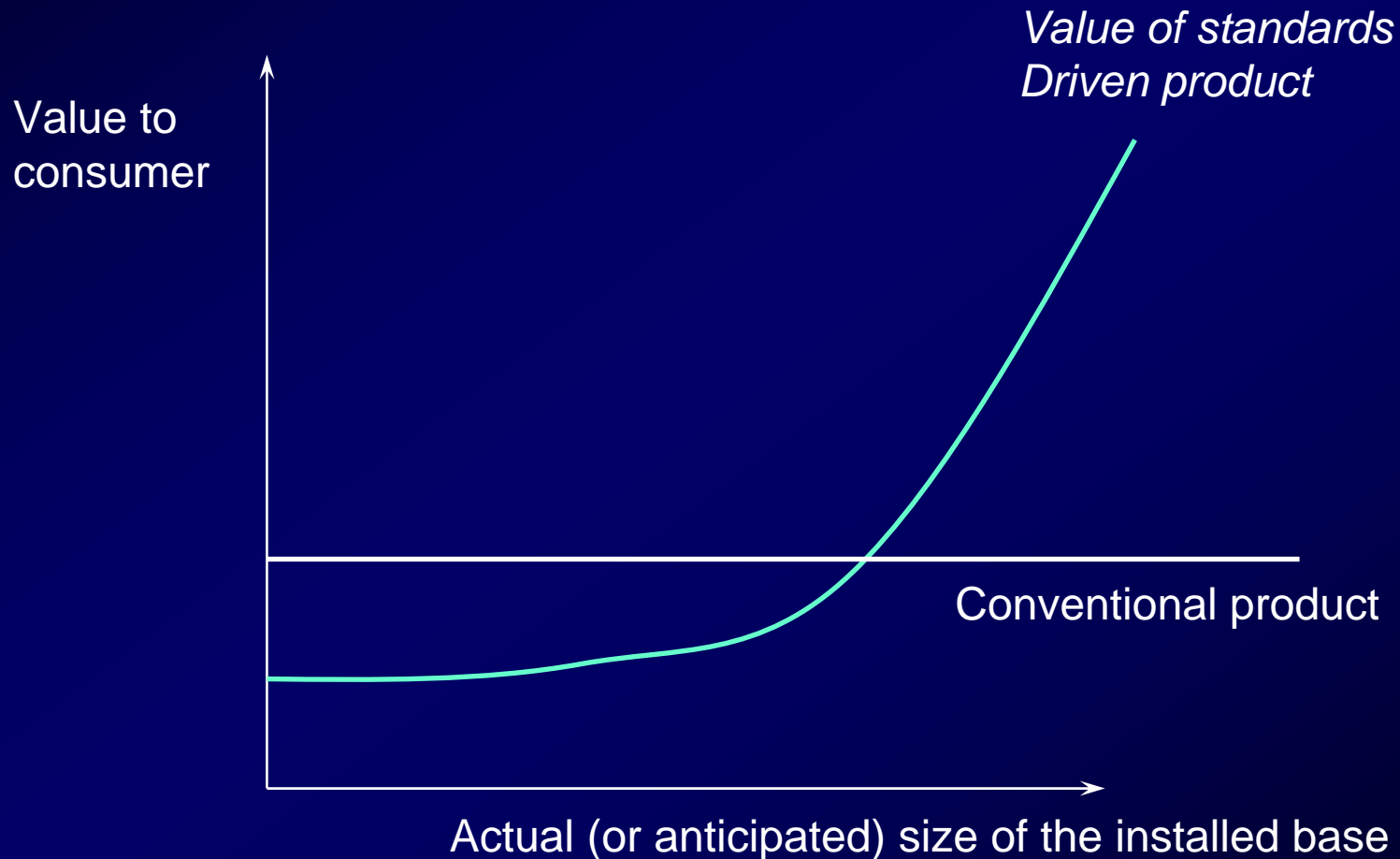
## Great Products

- Consumers base their purchase decision on the intrinsic value of the product to them
- *What would this be worth to me if I were the only buyer in the world?*
- Competition on the basis of features, price etc

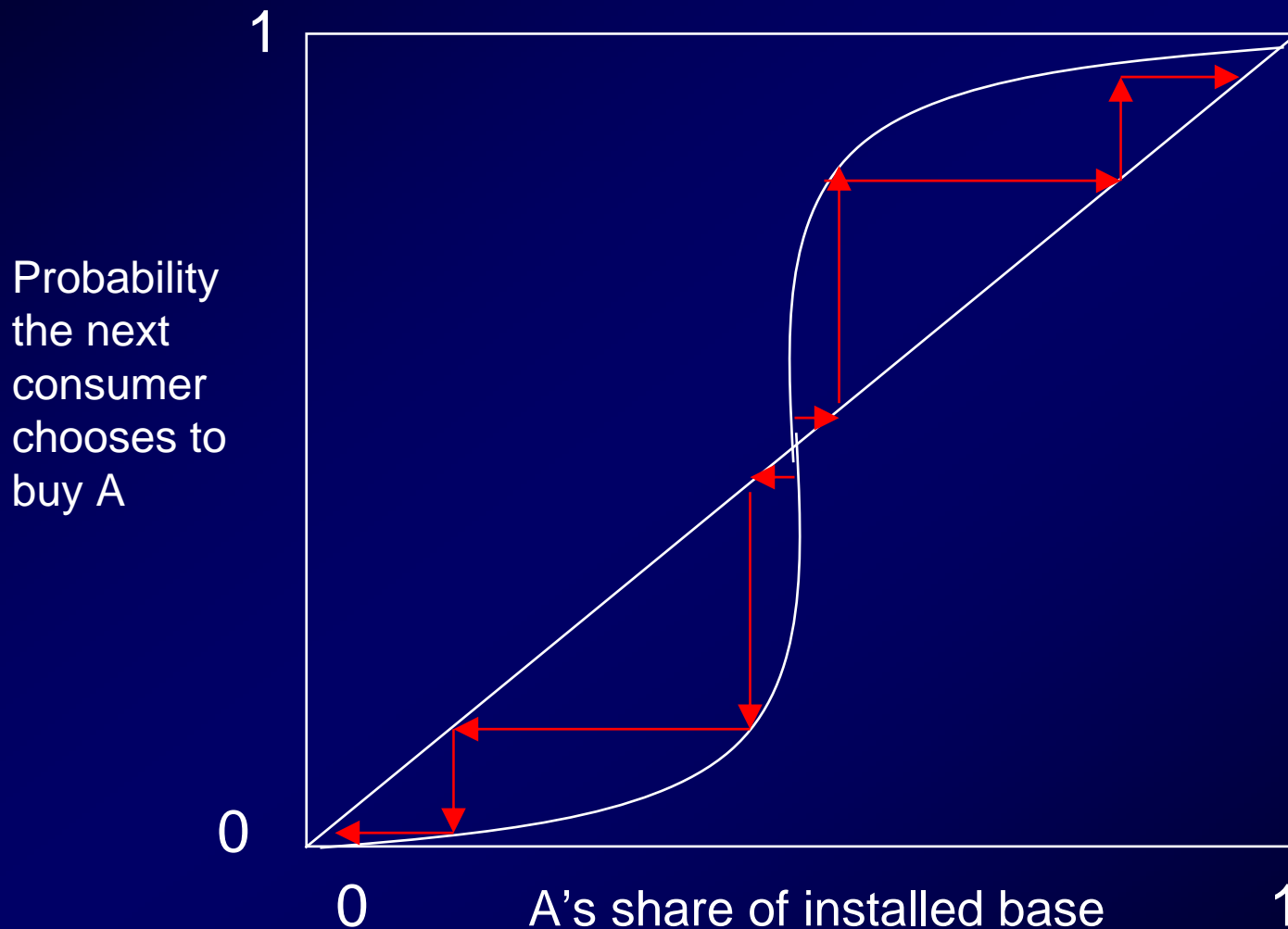
## Architectures

- Consumers base purchase decisions on the size of the (actual or projected) installed base and/or the (actual or projected) availability of network externalities
- *How many other people are likely to buy this product?*
- Competition on the basis of the size of network effects: installed base, availability of complementary products etc

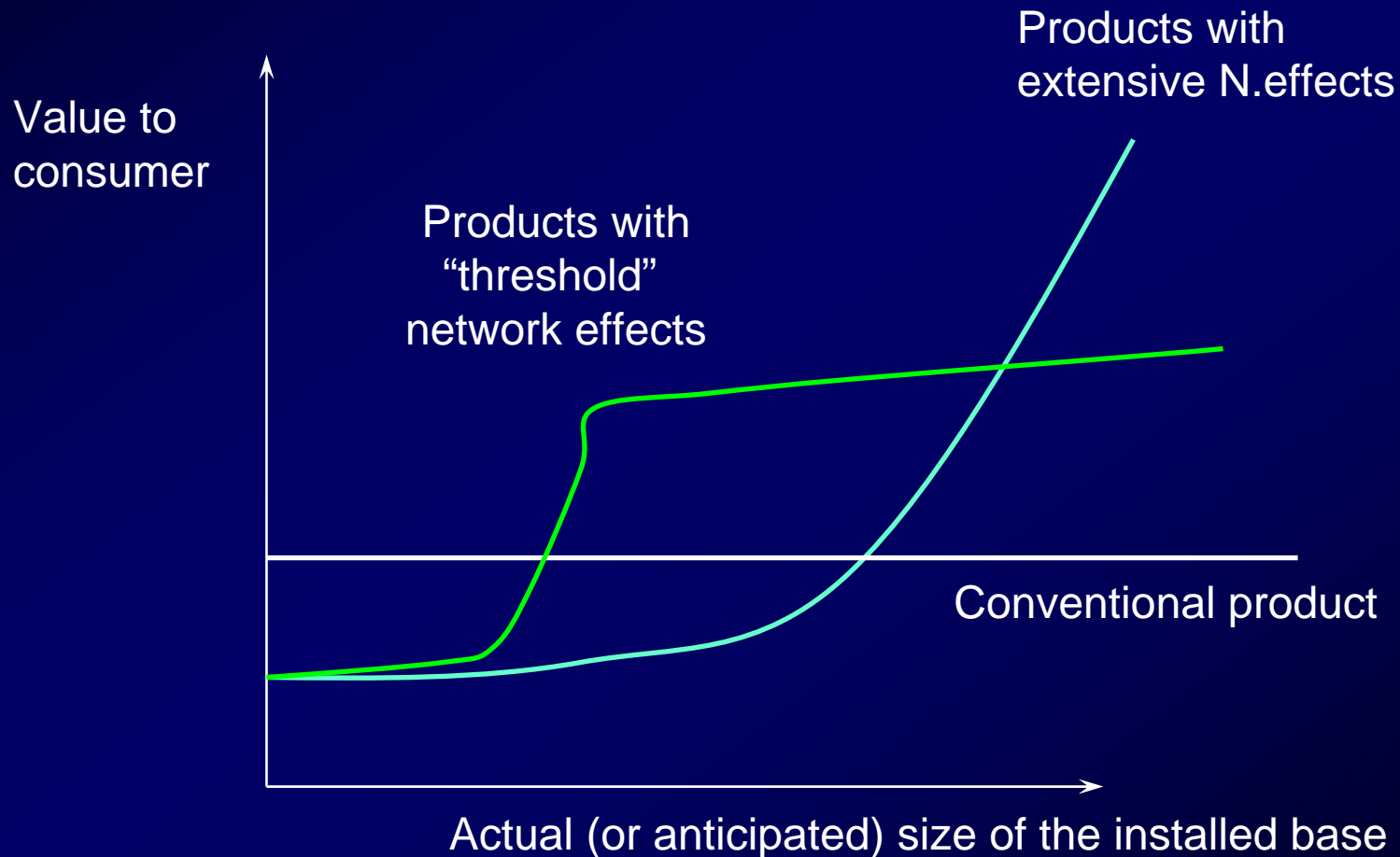
# With Strong Network Effects *Market Share Itself Creates Value*



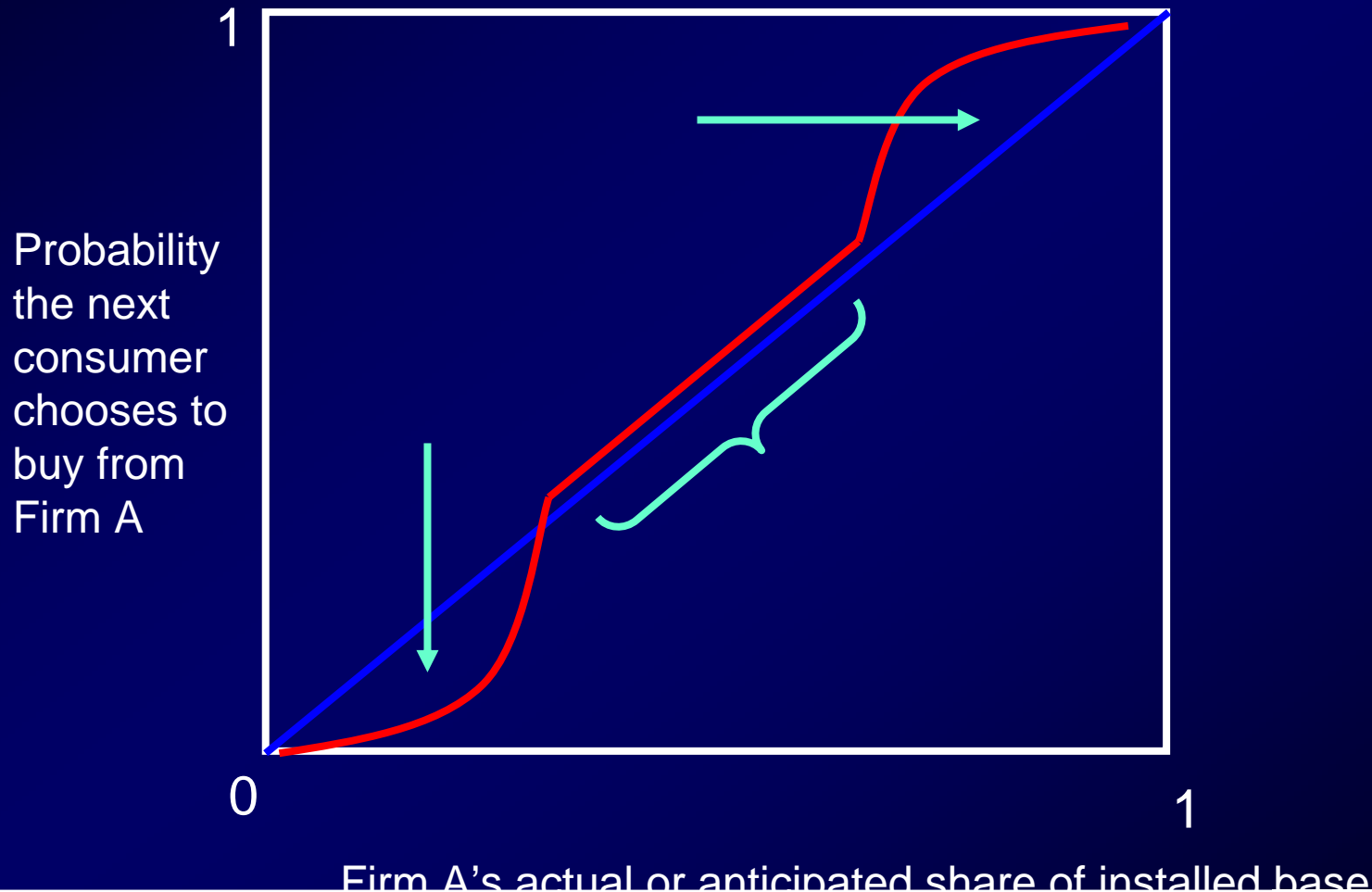
# If network effects are important, markets may “tip”



# Tipping dynamics differ with the strength of network effects

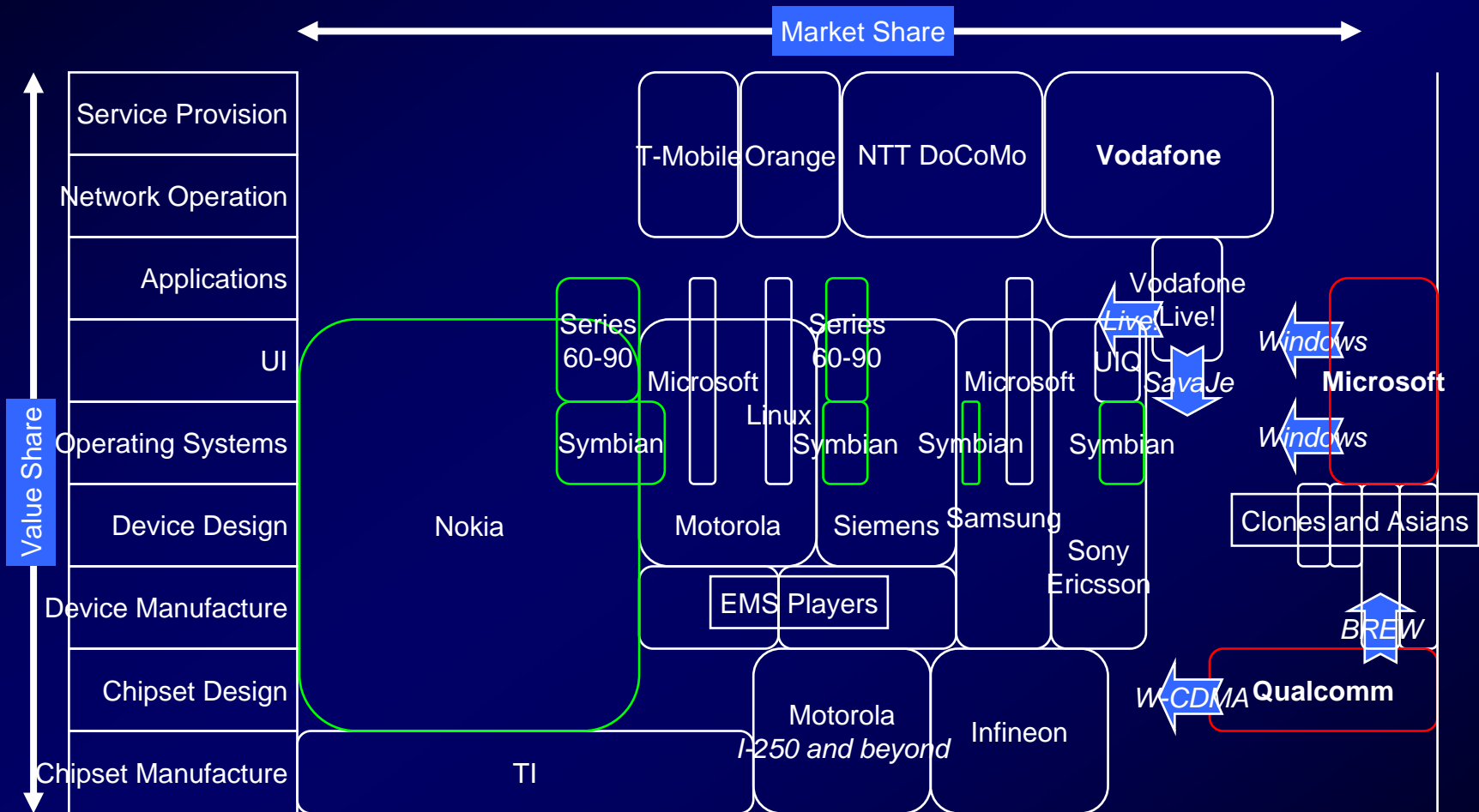


# Markets with moderate network effects only tip once critical thresholds are reached





# Will this market tip?



# How are standards established?

- Standards “win” when a critical mass of consumers have adopted them
- OR:
- When a critical mass of key players believe that the standard will be adopted.



# Establishing a standard: Sun

- Sun founded in 1982 to focus on the workstation market
- “Open” standard:
  - Standard components,
  - UNIX operating system

## Sun (2)

- 1980: Apollo founded
- 1983: Apollo has \$18m in sales, dominates the workstation market -- uses a proprietary operating system
- 1983: Sun has \$1m in sales, mostly to universities
- Lead customer, Computervision “likes the technology but doesn’t find the company credible” -- “we love your technology but there is no way you can supply it. Apollo is the standard in the industry, well financed and well managed.”
- What should Sun do?

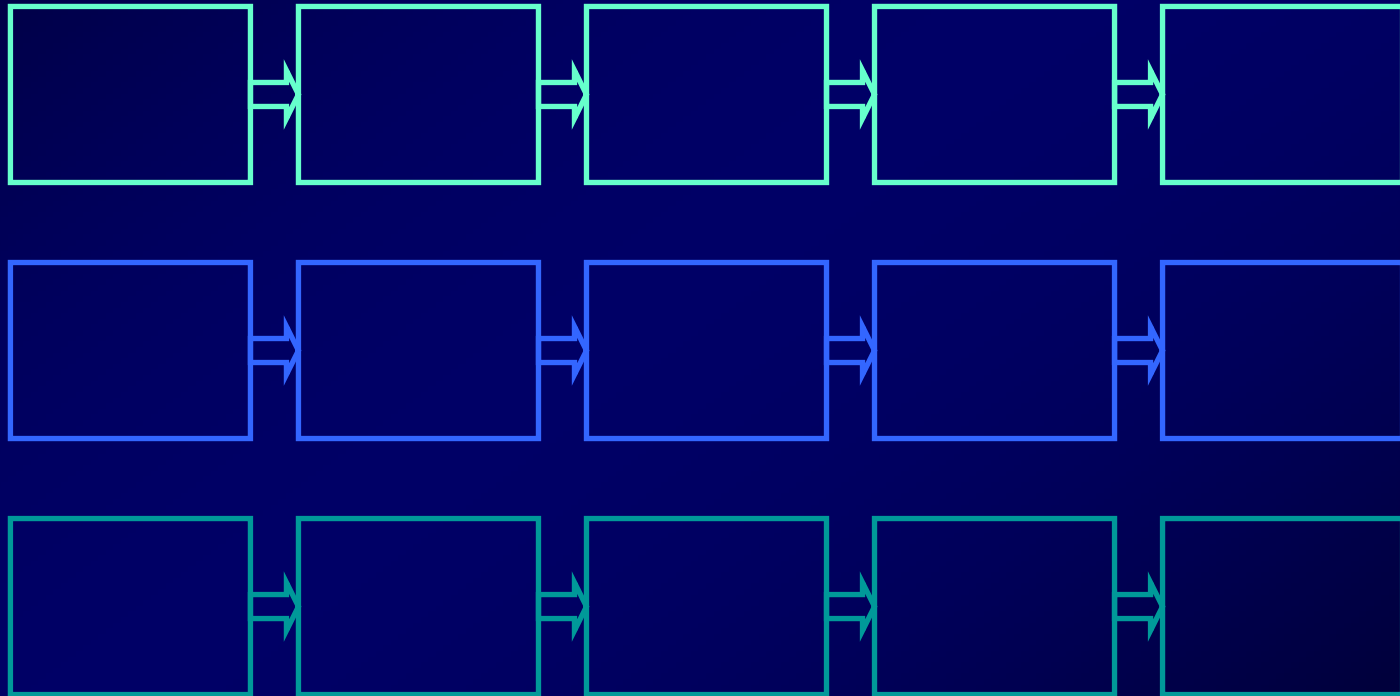
# Establishing a standard

- Introduce a great “product”
- Come to market ahead of competition
- Build expectations
- Develop, or encourage the development of, complementary products and services
- Give it away: put the standard in the public sector

# **Making money in an open world**

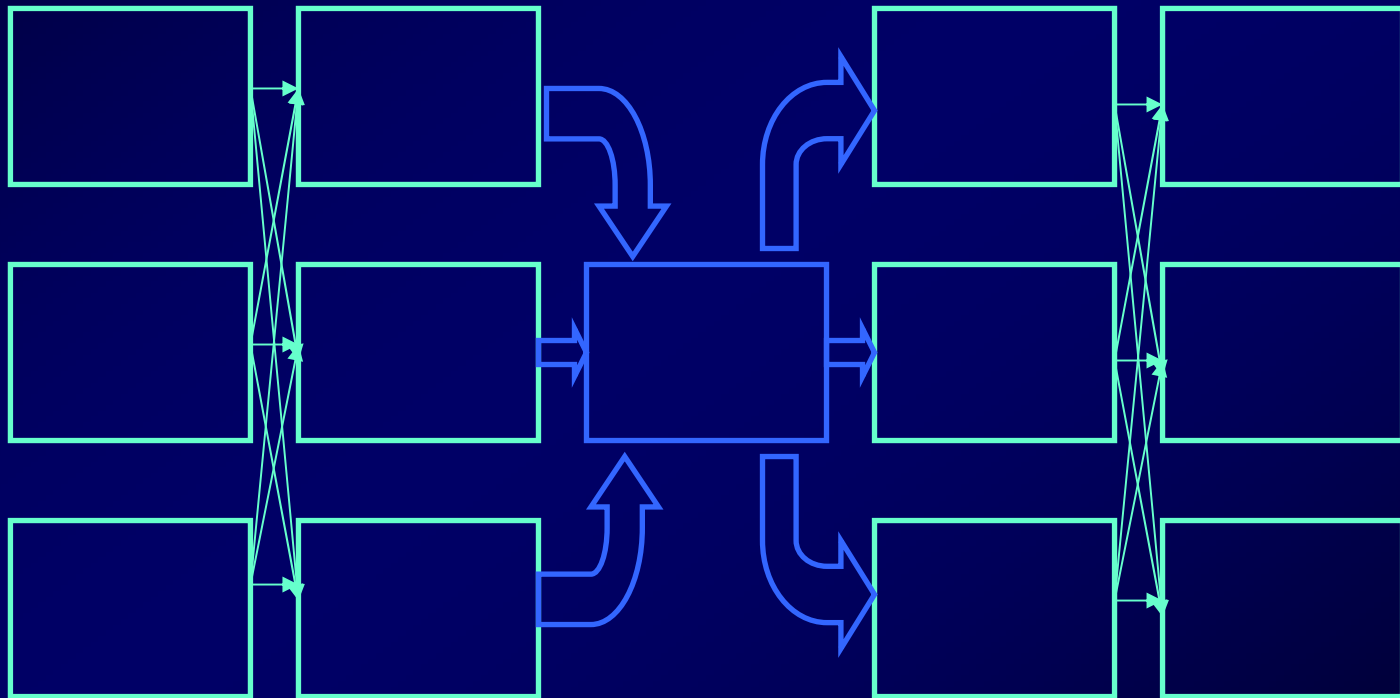
# Where's the money?

## Competition in a closed, private world



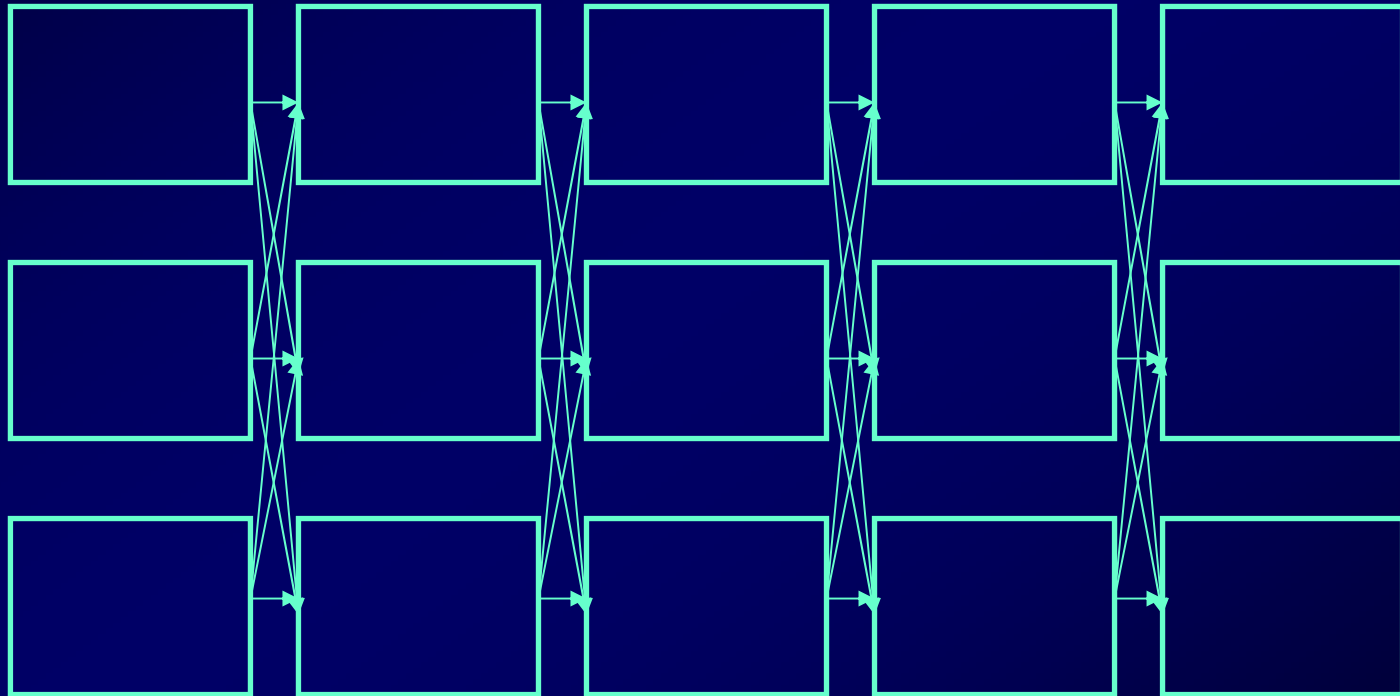
# Where's the money?

## Competition in an open private world



# Where's the money?

## The challenge of an open public world



# Making money in an open public world

- Competing on a level playing field:
  - Do it better, faster, cheaper, in a more integrated way...
  - Leverage “complementary assets”
- Be part of the evolution of the playing field:
  - Exploring “soft” standards



# Business models in the different quadrants

The technology is:

Open

Closed

Public

Compete on a level field  
Move to “soft” standards?  
Run hard

Control is:

Private

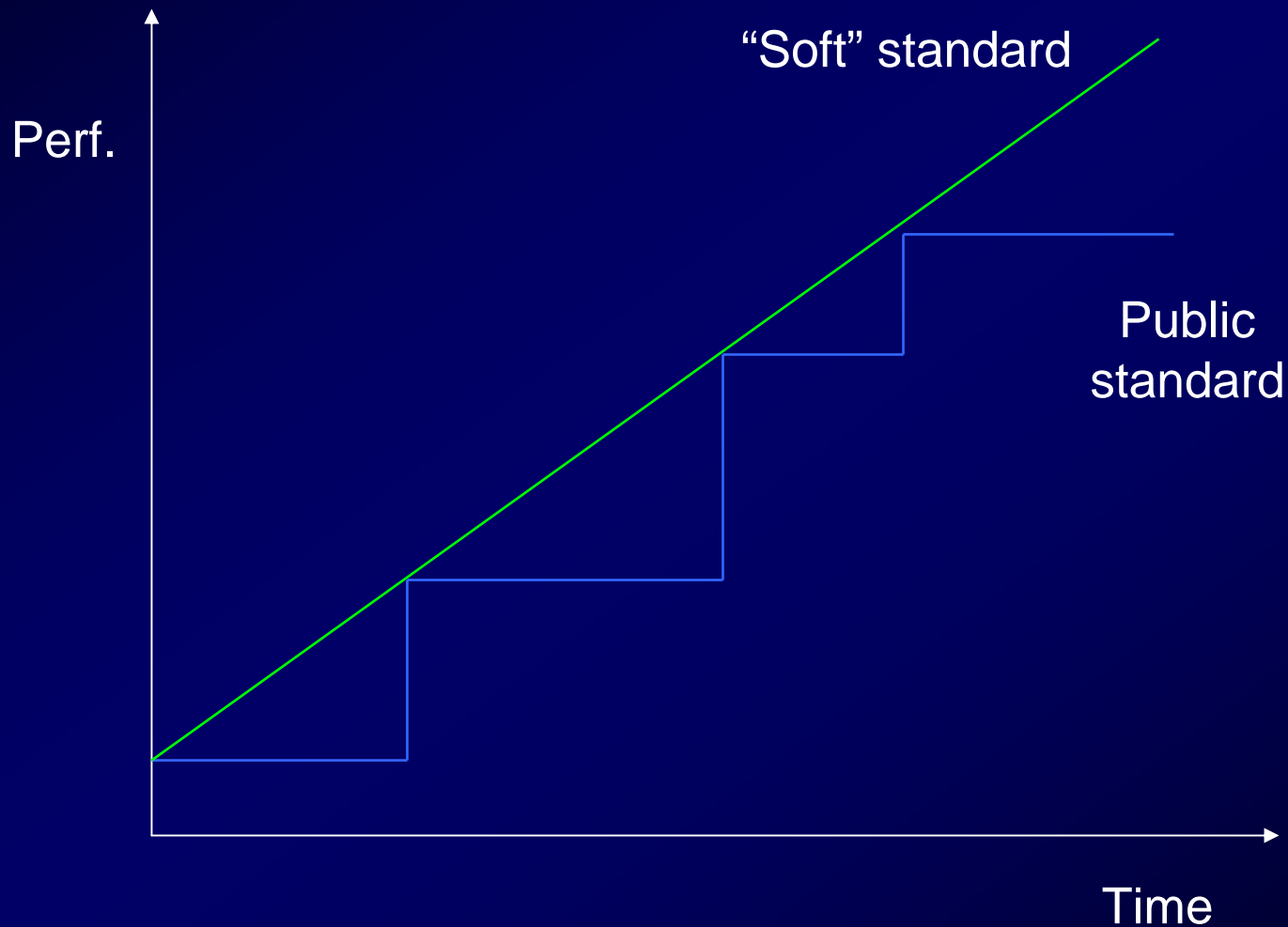
Encourage the “ecosystem”  
Embrace/extend  
Run hard

Deliver a best in class system  
Run hard

# Exploring soft standards

- A “soft” standard is a specification that is completely compatible with current public standards but offers enhanced functionality and performance
- It offers customers the security of knowing that they have avoided being “locked in” and an upgrade path to the public standard
- Plus the functionality and performance of a more finely “tuned” technology
- May permit significant premium pricing and the generation of customer loyalty

# Soft standards in action:



# Managing soft standards

- Maintaining customer trust is critical:
  - The instant they come to believe you're trying to lock them in, there will be trouble
- The technology task is complex. The “soft” standard must be:
  - Better than the public standard
  - Compatible with the current version
  - Compatible with future versions
- Ensuring that the “soft” technology is embodied in future generations of the technology may be a central strategic goal

# Summary

- The move from “product” to “system” competitions raises both strategic and organizational issues
- And increases the force behind the push for open standards
- Not all markets tip: but as network effects (connectivity, complementary services, tools, products) become more important, more and more will.
- Getting a private standard established in these kinds of worlds is likely to be very hard
- Fortunately, there are ways to make money in an open world - but managing a “soft” standard requires sustained attention

# Summary

# Outline:

- How will we create value?
  - How will the technology evolve?
  - How will the market change?
- How will we capture value?
  - How should we design the business model?
  - Where should we compete in the value chain?
  - **How should we compete if standards are important?**
- How will we deliver value?
  - How do we manage the core business and real growth simultaneously?
  - How do we use our strategy to drive real resource allocation?

# Putting the pieces together....

